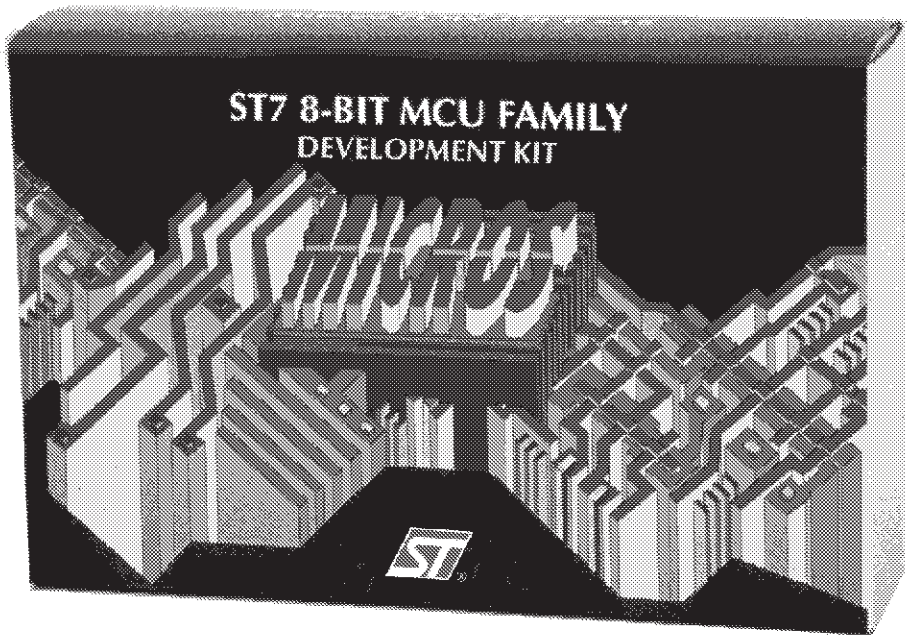
ST7 FAMILY
DEVELOPMENT KIT

MDT2 VERSION

GETTING STARTED



Release 1.0

NOVEMBER 1998

DOC- ST7MDT2-DVP

USE IN LIFE SUPPORT DEVICES OR SYSTEMS MUST BE EXPRESSLY AUTHORIZED.

STMicroelectronics PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF STMicroelectronics. As used herein:

1. Life support devices or systems are those which (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided with the product, can be reasonably expected to result in significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can reasonably be expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

TABLE OF CONTENTS

ST7 PRODUCT FINDER . . . . . .Page 4

ST7 INTRODUCTION 6

ST7 FAMILY OVERVIEW **7**

CPU CORE ARCHITECTURE **8**

ON-CHIP PERIPHERALS **9**

DEVELOPMENT AND SUPPORT **11**

DEVELOPMENT KIT - MDT2 VERSION 13

ST7 PRODUCT FINDER

	Device	OTP/ EPROM/ ROM x 8	RAM x 8	EEPROM x8	8-bit ADC Inputs	Watch-dog	16-bit Timers	Serial Comm. (Sync)	Serial Comm. (Async)	I/Os (High Current)	Package	Additional Features
BASIC	**ST72101G1**	4K	256	-	-	Yes	1	SPI	-	22 (8)	SDIP32/ SO28	
	ST72101G2	8K	256	-	-	Yes	1	SPI	-	22 (8)	SDIP32/ SO28	
	ST72121J2	8K	384	-	-	Yes	2	SPI	SCI	32 (4)	SDIP42/ TQFP44	Low Voltage Detector
	ST72121J4	16K	512	-	-	Yes	2	SPI	SCI	32 (4)	SDIP42/ TQFP44	
ADC	**ST72213G1**	4K	256	-	6	Yes	1	SPI	-	22 (8)	SDIP32/ SO28	
	ST72212G2	8K	256	-	6	Yes	2	SPI	-	22 (8)	SDIP32/ SO28	
	ST72311J2	8K	384	-	6	Yes	2	SPI	SCI	32 (4)	SDIP42/ TQFP44	Low Voltage Detector
	ST72311J4	16K	512	-	6	Yes	2	SPI	SCI	32 (4)	SDIP42/ TQFP44	
	ST72311N2	8K	384	-	8	Yes	2	SPI	SCI	44 (8)	SDIP56/ TQFP64	
	ST72311N4	16K	512	-	8	Yes	2	SPI	SCI	44 (8)	SDIP56/ TQFP64	
	ST72311N6*	32K	1024	-	8	Yes	2	SPI	SCI	44 (8)	TQFP64	
ADC+EEPROM	**ST72331J2**	8K	384	256	6	Yes	2	SPI	SCI	32 (4)	SDIP42/ TQFP44	Low Voltage Detector
	ST72331J4	16K	512	256	6	Yes	2	SPI	SCI	32 (4)	SDIP42/ TQFP44	
	ST72331N2	8K	384	256	8	Yes	2	SPI	SCI	44 (8)	SDIP56/ TQFP64	
	ST72331N4	16K	512	256	8	Yes	2	SPI	SCI	44 (8)	SDIP56/ TQFP64	
	ST72331N6*	32K	1024	256	8	Yes	2	SPI	SCI	44 (8)	TQFP64	
ADC+PWM	**ST72272K2**	8K	384	-	4	Yes	1	-	-	24 (4)	SDIP32/ SO34	DAC with PWM outputs
	ST72272K4	16K	512	-	4	Yes	1	-	-	24 (4)	SDIP32/ SO34	
	ST72372J4	16K	512	-	4	Yes	1	I^2C	-	30 (6)	SDIP42/ TQFP44	
	ST72371N4	16K	512	-	8	Yes	1	I^2C	SCI	39 (8)	SDIP56/ TQFP64	
I^2C	**ST72251G1**	4K	256	-	6	Yes	2	I^2C+SPI	-	22 (8)	SDIP32/ SO28	
	ST72251G2	8K	256	-	6	Yes	2	I^2C+SPI	-	22 (8)	SDIP32/ SO28	

INTRODUCTION

	Device	OTP/ EPROM/ ROM x 8	RAM x 8	EEPROM x8	8-bit ADC Inputs	Watch-dog	16-bit Timers	Serial Comm. (Sync)	Serial Comm. (Async)	I/Os (High Current)	Package	Additional Features
CAN	**ST72512N2***	8K	384	-	8	Yes	1	SPI	-	44 (4)	SDIP56/ TQFP64	CAN peripheral
	ST72511R4*	16K	512	-	8	Yes	2	SPI	SCI	44 (4)	TQFP64	
	ST72511R6*	32K	1024	-	8	Yes	2	SPI	SCI	44 (4)	TQFP64	
	ST72532N2*	8K	384	256	8	Yes	1	SPI	-	44 (4)	SDIP56/ TQFP64	
	ST72531R4*	16K	512	256	8	Yes	2	SPI	SCI	44 (4)	TQFP64	
	ST72531R6*	32K	1024	256	8	Yes	2	SPI	SCI	44 (4)	TQFP64	
USB	**ST72671N4***	16K	512	-	8	Yes	1	I^2C	SCI	34 (8)	SDIP56/ TQFP64	USB peripheral + DAC with PWM outputs
	ST72671N6*	32K	1024	-	8	Yes	1	I^2C	SCI	34 (8)	SDIP56/ TQFP64	

* Not yet available. Contact sales office for data and availability.

Abbreviations:

ADC = Analog to Digital Converter
CAN = Controller Area Network
DAC = Digital to Analog Converter
I^2C = I^2C Multimaster
PWM = Pulse Width Modulation
SCI = Serial Communications Interface
SPI = Serial Peripheral Interface
USB = Universal Serial Bus
WDG = Watchdog

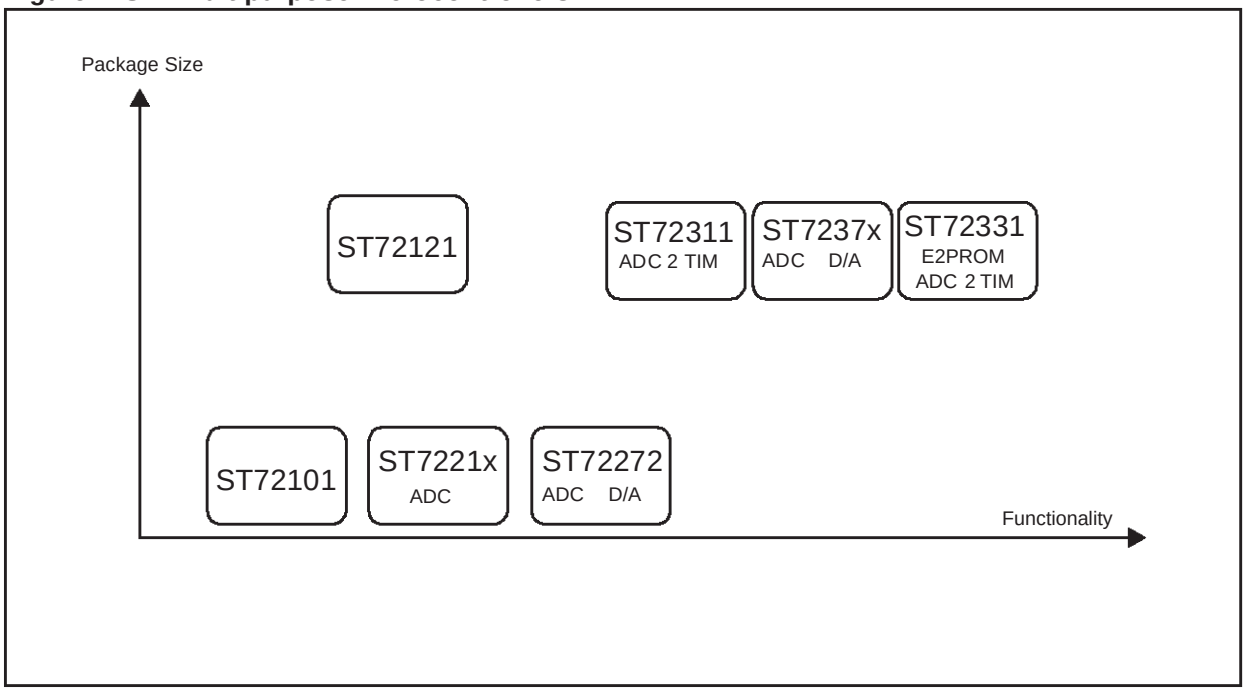
Packages:

DIP = Dual In Line
SO = Small Outline
QFP = Quad Flat Pack
S = Shrink
T = Thin

INTRODUCTION

The ST7 Industry-Standard microcontroller family offers a wide range of MCU solutions for industrial, automotive (CAN), computer peripherals (USB) and consumer applications. The ST7 has been used for many years in high volume dedicated applications such as monitors and car radios. Based on an industry-standard 8-bit architecture, extended by STMicroelectronics to better accommodate high level language programming, the ST7 is designed to target small and medium sized applications with the requirements of excellent system price/performance, short application development cycle and outstanding quality and reliability. The powerful on-chip peripherals add functionality to the ST7 core and a range of different versions and package sizes to allow the user select the device that best matches the needs of the application.

Figure 1. ST7 Multipurpose Microcontrollers



INTRODUCTION

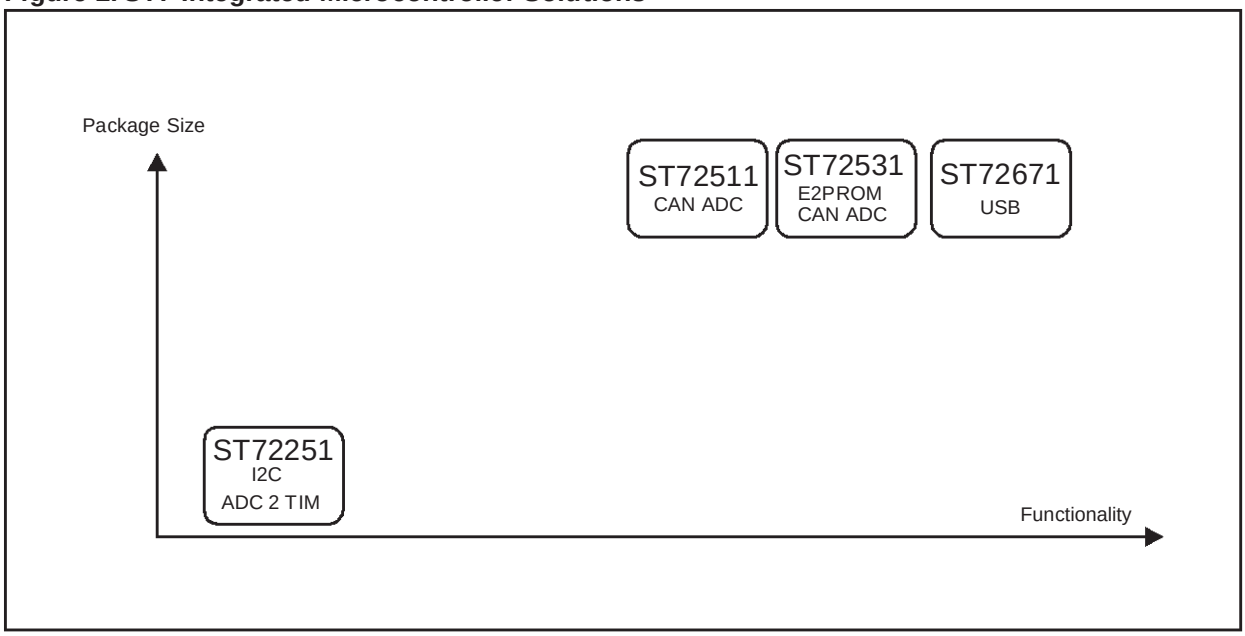
ST7 FAMILY OVERVIEW

The range of six SMD and pin-through packages are available (28, 32, 42, 44, 56 or 64-pin) with a broad mix of on-chip resources giving designers considerable choice when selecting components and determining overall hardware cost.

All devices are available in a wide range of program and data memory sizes. ROM program memory is available for high volume production. On ROM devices the customer's program code is mask programmed by STMicroelectronics during the device manufacture. OTP (One Time Programmable) versions are particularly adapted to small and medium production volumes, as well as to products using different firmware versions or with code that is frequently updated. OTP devices are programmable by the customer using STMicroelectronics or third-party EPROM programmers. EPROM versions can be used during development and prototyping as the program memory can be erased and programmed as often as required.

Available on-chip peripherals include a 16-bit Timer, Watchdog timer, A/D converter, D/A converter, asynchronous communications interface, SPI, I^2C, USB and CAN interfaces. On-chip EEPROM is available on some devices.

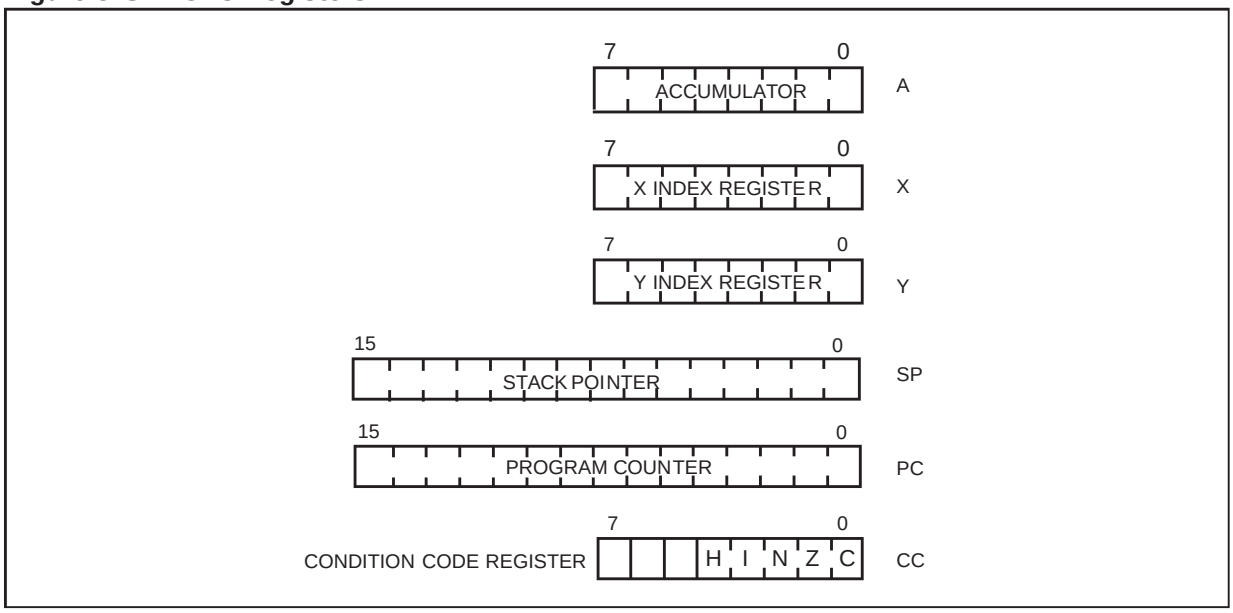
Figure 2. ST7 Integrated Microcontroller Solutions



CPU CORE ARCHITECTURE

The industry-standard 8-bit accumulator-based architecture features 6 internal registers including a 16-bit program counter. The instruction set has 63 instructions with 17 addressing modes offering 8x8 bit unsigned multiply, true bit manipulation, various bit/byte transfer modes and powerful branching logic. Peripheral resources are handled via dedicated interrupts and registers.

Figure 3. ST7 CPU Registers



INTRODUCTION

ON-CHIP PERIPHERALS

Parallel I/O Ports

The bidirectional parallel I/O lines are generally grouped as ports of 8 lines each. The number of I/O lines depends on the specific device pinout. The I/O lines can be shared between other on-chip peripherals (alternate functions) and any general purpose I/O function defined by the application. Data is input and output via data registers (one for each port). Data Direction and Option registers allow each line to be individually configured to the application's requirements.

16-Bit Timer

The 16-bit timer can be used for a wide range of standard timing tasks. It has a 16-bit free running counter with programmable prescaler. Each timer can have up to 2 input capture and 2 output compare pins with associated registers. This allows applications to measure pulse intervals or generate pulse waveforms. Timer overflow and other events are flagged in a status register with optional interrupt generation.

Watchdog Timer

The watchdog timer consists of a 7-bit reloadable downcounter that triggers a device reset if it reaches a predefined value. During normal operation, the application reloads the counter at regular intervals to prevent a reset occurring. By this means, if the application hangs, the condition is automatically cleared by resetting the MCU. The "software watchdog" is enabled by software. The "hardware watchdog" is permanently enabled by hardware.

Analog to Digital Converter

The ADC peripheral multiplexes up to 8 analog input channels. It converts the analog input to 8-bit value using monotonic successive approximation. The analog input voltage must lie within the supply voltage range, which is used as the analog reference.

Digital to Analog Converter

The Digital to Analog converter generates 10-bit pulse width modulated signals with a software programmable duty cycle. These signals with external RC filtering, can be used to replace potentiometers and analog voltage control sources. A 12- bit channel is available on some devices.

Asynchronous Serial Communications

The Serial Communications Interface (SCI) offers a flexible means of full-duplex data exchange with external equipment requiring an industry standard NRZ asynchronous serial data format. A very wide range of baud rates are available using to dual baud rate generator systems on both receive and transmit channels. Transmitter and receiver circuits are independent and can operate at different baud rates.

SPI Serial Peripheral Interface

The SPI peripheral is a synchronous serial interface for Master and Slave device communications. Single master and multimaster mode systems are supported for communication with external peripherals or other microprocessors. Dedicated registers and interrupts allow full software control and user defined protocols.

USB Interface

The USB is standard serial bus intended primarily for PC peripherals such as monitors, keyboards, joysticks, multimedia devices, scanners, etc. It allows such devices to be connected or removed without rebooting or installing drivers. The ST7 peripheral implements the USB low speed function interface. Data transfer is performed by DMA. The USB

peripheral has an integrated 3.3V voltage regulator and a transceiver. Suspend and Resume operations are supported.

I^2C Bus Interface

The I^2C bus is a synchronous serial bus for connecting multiple devices using a data line and a clock line. The ST7 I^2C interface operates in multimaster or slave mode and supports speeds of up to 400 KHz. Bus events (Bus busy, slave address recognised) and error conditions are automatically flagged in peripheral registers and interrupts are optionally generated. The interface supports 7 and 10-bit addressing.

CAN Bus Interface

The Controller Area Network (CAN) protocol is becoming more and more widely accepted in Europe and throughout the world. It enables the creation of networks inside a vehicle or an industrial system with high tolerance to error in noisy environments. The Controller area network peripheral conforms to the CAN Specification 2.0 active and 2.0B passive. The interface has three 10-bit transmit/ receive buffers and two 12-bit message acceptance filters. The Baud rates are programmable up to 1 Mbit/sec.

DEVELOPMENT & SUPPORT

Full Hardware and Software Development Support

A full range of development tools is available, including In-Circuit Emulators, OTP/EPROM programming boards and Gang programmers for each device. Software development tools include Assembly Language and C Language programming suites, as well as a proprietary Windows Debugger and a third party Debugger.

Software Development Tools

A full range of development software tools is available for the ST7 family of Microcontrollers. This currently comprises four principal product groups:

- an Assembly Language suite: "**SOFTWARE TOOLS for the ST7 Family**"
- a proprietary Debugger: "**WGDB7 Windows GNU Debugger for the ST7 Family**"
- a third party C-Language suite: "**HIWARE C TOOLCHAIN for the ST7 Family**"
- a third party Debugger: "**HIWARE SOURCE DEBUGGER for the ST7 Family**"

The available products are listed below, together with the relevant upgrade versions.

Sales Type	Product Name	Description
(*)	Software Tools for the ST7 Family	DOS Macro -Assembler, Linker, Library Archiver and Executable File Formatter for the ST7 Family of MCUs
(*)	WGDB7 Windows GNU Debugger for the ST7 Family	Windows based GNU Debugger for the ST7 Family of MCUs
ST7-SWCHIW/PC Upgrade: ST7-SWCHIW/PC-UP	HIWARE C Toolchain for the ST7 Family	Windows based C Language Toolchain for program development
ST7-SWDHIW/PC Upgrade: ST7-SWDHIW/PC-UP	HIWARE Source Debugger for the ST7 Family	Windows based ST7 Debugger suite

(*) These software suites are supplied as standard issue with the ST7 Emulator.

ST7 Family Development Tools Overview

ROM	Dev. KIT	EMULATOR	Emulator Probes
BASIC			
ST72101G1	ST7MDT1-DVP	ST7MDT1-EMU2	SDIP32, SO28
ST72101G2			
ST72121J2	ST7MDT2-DVP	ST7MDT2-EMU2	SDIP42, TQFP44 SDIP56, TQFP64
ST72121J4			
ADC			
ST72213G1	ST7MDT1-DVP	ST7MDT1-EMU2	SDIP32, SO28
ST72212G2			
ST72311J2	ST7MDT2-DVP	ST7MDT2-EMU2	SDIP42, TQFP44 SDIP56, TQFP64
ST72311J4			
ST72311N2			
ST72311N4			
ST72311N6 (1)	-	ST7MDT3-EMU2	SDIP56, TQFP64
ADC + EEPROM			
ST72331J2	ST7MDT2-DVP	ST7MDT2-EMU2	SDIP42, TQFP44 SDIP56, TQFP64
ST72331J4			
ST72331N2			
ST72331N4			
ST72331N6 (1)	-	ST7MDT3-EMU2	SDIP56, TQFP64
ADC + DAC			
ST72272K2	-	ST7MDT4-EMU2	SDIP32, SDIP42, SO34, SDIP56, TQFP64
ST72272K4			
ST72372J4			
ST72371N4			
I2C			
ST72251G1	ST7MDT1-DVP	ST7MDT1-EMU2	SDIP32, SO28
ST72251G2			
CAN (1)			
ST72512N2	-	ST7MDT3-EMU2	TQFP64, SDIP56
ST72512N2			
ST72511R6			
ST72532N2			
ST72531R4			
ST72531R6			
USB			
ST72671N4	-	ST7MDT4-EMU2	SDIP32, SO34, SDIP42, SDIP56, TQFP64
ST72671N6			

(1) Contact Sales Office,

ST7 Family Programming Tools Overview

ROM	EPROM (3)	OTP (3)	STARTER KIT	DVP KIT	EPB
BASIC					
ST72101G1	ST72E251G2D0	ST72T101G1	ST7MDT1-KIT	ST7MDT1-DVP	ST7MDT1-EPB
ST72101G2		ST72T101G2			
ST72121J2	ST72E311J4D0S	ST72T121J2S	ST7MDT2-KIT	ST7MDT2-DVP	ST7MDT2-EPB
ST72121J4		ST72T121J4S			
ADC					
ST72213G1	ST72E251G2D0	ST72T213G1	ST7MDT1-KIT	ST7MDT1-DVP	ST7MDT1-EPB
ST72212G2		ST72T212G2			
ST72311J2	ST72E311J4D0S	ST72T311J2S	ST7MDT2-KIT	ST7MDT2-DVP	ST7MDT2-EPB
ST72311J4		ST72T311J4S			
ST72311N2	ST72E311N4D0S	ST72T311N2S			
ST72311N4		ST72T311N4S			
ST72311N6 (1)	ST72E531R6D0	ST72T311N6	-	-	ST7MDT3-EPB
ADC + EEPROM					
ST72331J2	ST72E331J4D0S	ST72T331J2S	ST7MDT2-KIT	ST7MDT2-DVP	ST7MDT2-EPB
ST72331J4		ST72T331J4S			
ST72331N2	ST72E331N4D0S	ST72T331N2S			
ST72331N4		ST72T331N4S			
ST72331N6 (1)	ST72E531R6G0	ST72T331N6	-	-	ST7MDT3-EPB (2)
ADC + DAC					
ST72272K2	ST72E272K4D0	ST72T272K2	ST7MDT4-KIT	-	ST7MDT4-EPB
ST72272K4		ST72T272K4			
ST72372J4	ST72E671J4D0	ST72T371J4			
ST72371N4	ST72E671N4D0	ST72T371N4			
I2C					
ST72251G1	ST72E251G2D0	ST72T251G1	ST7MDT1-KIT	ST7MDT1-DVP	ST7MDT1-EPB
ST72251G2		ST72T251G2			
CAN (1)					
ST72512N2	ST72E531R6G0	-	-	-	ST7MDT3-EPB (2)
ST72512N2		ST72T511R4			
ST72511R6		ST72T511R6			
ST72532N2		-			
ST72531R4		ST72T531R4			
ST72531R6		ST72T531R6			
USB					
ST72671N4	ST72E671N6D0	ST72T671N4	ST7MDT4-KIT	-	ST7MDT4-EPB
ST72671N6		ST72T671N6			

(1) Contact Sales Office,

(2) ST7MDT2-EPB can be Used

(3) 'S' is an optional character. sales types without final 'S' refer to devices without the safe reset (LVD) option. For Gang Programmers, Please Contact Third Parties.

DEVELOPMENT KIT
MDT2 VERSION

Notes:

PREFACE

Purpose of the Manual

This manual describes how to start and use the ST7MDT2-DVP Development Kit for the ST72331N4 series MCUs, allowing you to get acquainted with the ST7 microcontroller world and become familiar with the methods for developing and debugging ST7-driven applications.

The ST72331N4 series covers the ST72121J2/J4, ST72311J2/J4, ST72311N2/N4, ST72331J2/J4 and ST72331N2/N4 MCUs.

The manual also provides guidance for programming a selection of ST7 EPROM or OTP microcontrollers.

Audience

This book is intended for persons:

- who wish to evaluate how to design and test applications using ST7 microcontrollers,
- who want to use the ST7MDT2-DVP Development Kit to meet their actual application development needs.

Related Publications

The following publications contain useful complementary information:

- ***ST7-Family, Data Sheets***,
- ***ST7-Family, 8-bit MCUs, Product Overview***, Ref. BKST7/2
- ***Software Tools for the ST7 Family***, Ref. Doc-ST7ASMLK-SW
- ***ST7-Family, Programming Manual***,
- ***Windows Debugger for the ST7 Family***, Doc-ST7-WGDB7. This manual will help you debug and finalize your programs.

Table of Contents

ST7MDT2-DVP 3

1 Structure of the Development Kit 7
1.1 A WIDE RANGE OF FUNCTIONS 7
1.2 PACKAGE DESCRIPTION 8
1.3 BOARD FUNCTIONAL CONFIGURATIONS 10
1.4 DEVELOPMENT BOARD LAYOUT 12

2 What the Development Kit Offers You 13
2.1 OVERVIEW 13
2.1.1 Connecting and Powering Up the Development Board 13
2.1.2 Installing and Setting Up the Software 13
2.2 WORKING WITH THE DEVELOPMENT KIT 14

3 Getting Started 15
3.1 HARDWARE INSTALLATION 15
3.1.1 Antistatic Requirements 15
3.1.2 Powering Up the Development Board 15
3.2 SOFTWARE INSTALLATION 16
3.3 USING THE ST ASSEMBLY CHAIN 20
3.4 STARTING THE WGDB7 DEBUGGER 21
3.5 PROGRAMMING ST7 DEVICES 22
3.5.1 Target Devices 22
3.6 DEVICE INSTALLATION 22
3.6.1 Starting the Windows Epromer 23
3.6.2 Configuring the Epromer 23

4 Hardware Features 27
4.1 EMULATOR 27
4.1.1 General Layout 27
4.1.2 CPU 27
4.1.3 Clock 29
4.1.4 Memory 30
4.1.5 On-Chip Peripherals 30
4.1.6 Hardware Breakpoint Capabilities 33
4.1.7 Input Trigger 33
4.1.8 External Output Trigger 34
4.2 CONNECTION TO EXTERNAL USER RESOURCES 34
4.2.1 Pin Description 34
4.2.2 Supplying Power to the Application Board 38
4.2.3 Limitations 38
4.3 DEVICE PROGRAMMER 40
4.3.1 General Layout 40
4.3.2 Targets 40
4.4 LINK TO PC 40
4.5 POWER SUPPLY 40

Table of Contents

5 Software Features 42
5.1 TOOLS 42
5.2 ST ASSEMBLY CHAIN FOR ST7 FAMILY 42
5.3 HIWARE C COMPILER DEMONSTRATION CHAIN. 43
5.4 ST7 SIMULATOR 43
5.5 ST7 WINDOWS DEBUGGER 43
5.6 EPROMER FOR ST7 MCUS 45
6 TROUBLESHOOTING 46
6.1 ERROR MESSAGES 46

Standard Compliance

This product conforms to the 89/336/EEC Directive. It complies with the EN55022 emissions standard for ITE and generic 50082-1 immunity standards.

WARNING

The ST7MDT2-DVP Development Kit board is a Class-A apparatus. It should not be used in a residential area as it may cause radioelectrical disturbances. Also, the The ST7MDT2-DVP Development Kit board is not contained in an outer casing; consequently, it is not immune against electrostatic discharges (ESD). It should therefore be handled only in static safe working areas.

See also : “Antistatic Requirements” on page 13.

1 STRUCTURE OF THE DEVELOPMENT KIT

1.1 A Wide Range of Functions

The ST7MDT2-DVP Development Kit for the ST72331N4 series MCUs contains all the necessary resources that will help you:

- design,
- develop,
- debug ST7 application software running in a real environment,
- and program ST72121J2/J4, ST72311J2/J4, ST72311N2/N4, ST72331J2/J4 and ST72331N2/N4 devices in both EPROM and OTP modes.

NOTE: These functions are currently available for devices with SDIP42 and SDIP56 packages. You may however program (and only program) devices with TQFP64 packages by adding the appropriate ZIF socket on the board (See “Development Board Layout” on page 10).

Table 1. ST72331N4 Series Summary

Device	ROM	RAM	A/D	Timer	SPI	SCI	EEPROM
ST72121J2	8K	384	No	2x16 bits	Yes	Yes	No
ST72121J4	16K	512	No	2x16 bits	Yes	Yes	No
ST72311J2	8K	384	Yes	2x16 bits	Yes	Yes	No
ST72311J4	16K	512	Yes	2x16 bits	Yes	Yes	No
ST72311N2	8K	384	Yes	2x16 bits	Yes	Yes	No
ST72311N4	16K	512	Yes	2x16 bits	Yes	Yes	No
ST72331J2	8K	384	Yes	2x16 bits	Yes	Yes	256
ST72331J4	16K	512	Yes	2x16 bits	Yes	Yes	256
ST72331N2	8K	384	Yes	2x16 bits	Yes	Yes	256
ST72331N4	16K	512	Yes	2x16 bits	Yes	Yes	256

1.2 Package Description

The ST7MDT2-DVP Development Kit package contains:

Hardware

- One development board with a cable for PC connection (Ref. MB 242/B),
- One SDIP56 passive probe (Ref. DB 347/A) and two 50-pin flat cables for user application connection,
- One 5 V external DC power supply with cable,
- One adapter SDIP56-SDIP42 (Ref. DB326),
- One CD ROM and disks for documentation and software.

The board is connected through a parallel port interface to a PC used to monitor debugging and device programming operations.

Software and Documentation

The CD-ROM and the disks contain:

- The present guide,
- An emulator-aided debugger,
- Software Tools, comprising:
  - a source-level debugger operating with the development board or an ST7 simulator
  - an assembler
  - a linker
  - an ST7 eprom programmer
  - associated user documentation
- A basic C-compiler, for demonstration purposes only,
- A device epromer,
- ST7 application notes, with sources.

Figure 1. Software/Hardware Structure of the ST7MDT2-DVP Development Kit

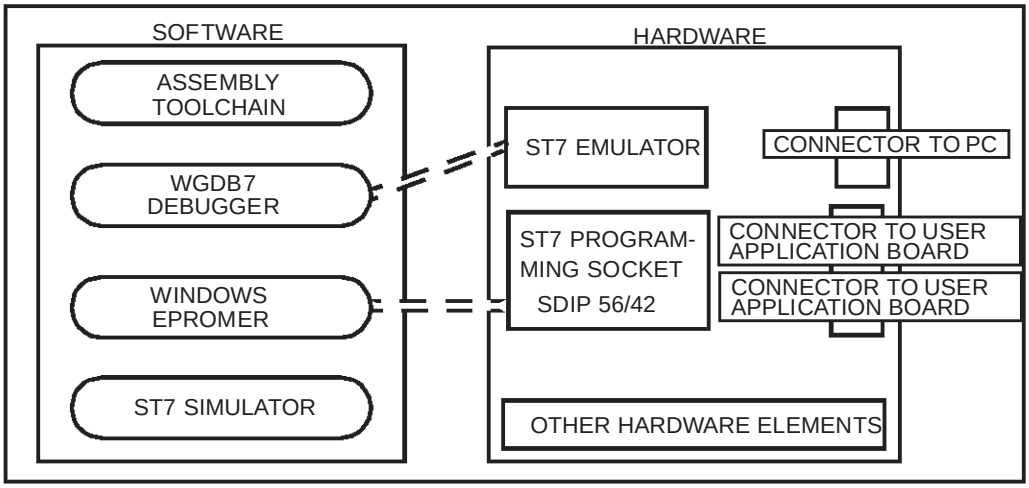
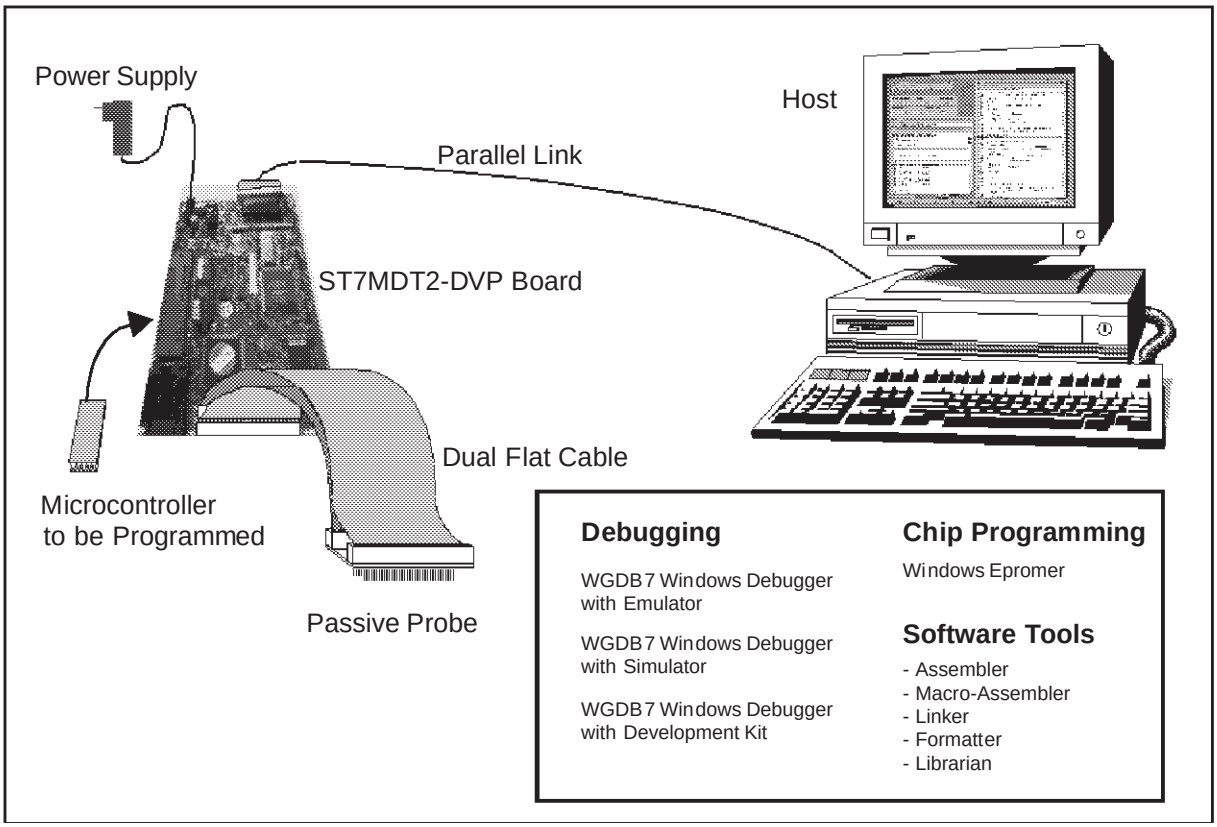


Figure 2. ST7MDT2-DVP Development Kit General Configuration



1.3 Board Functional Configurations

The development board of the ST7MDT2-DVP Development Kit can be used as an ST7 MCU Emulator or as an ST7 MCU Programming Board, as shown in the figures next page.

Figure 3. Using the Development Board as an ST7 MCU Emulator

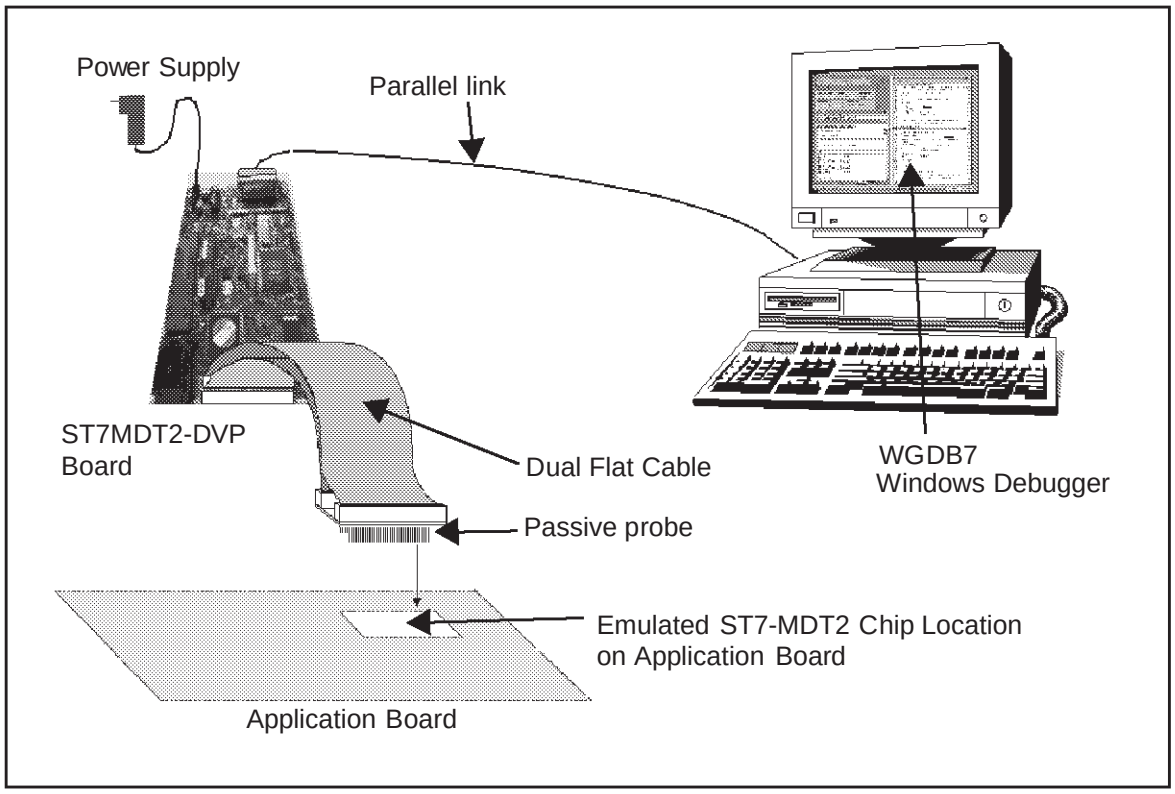
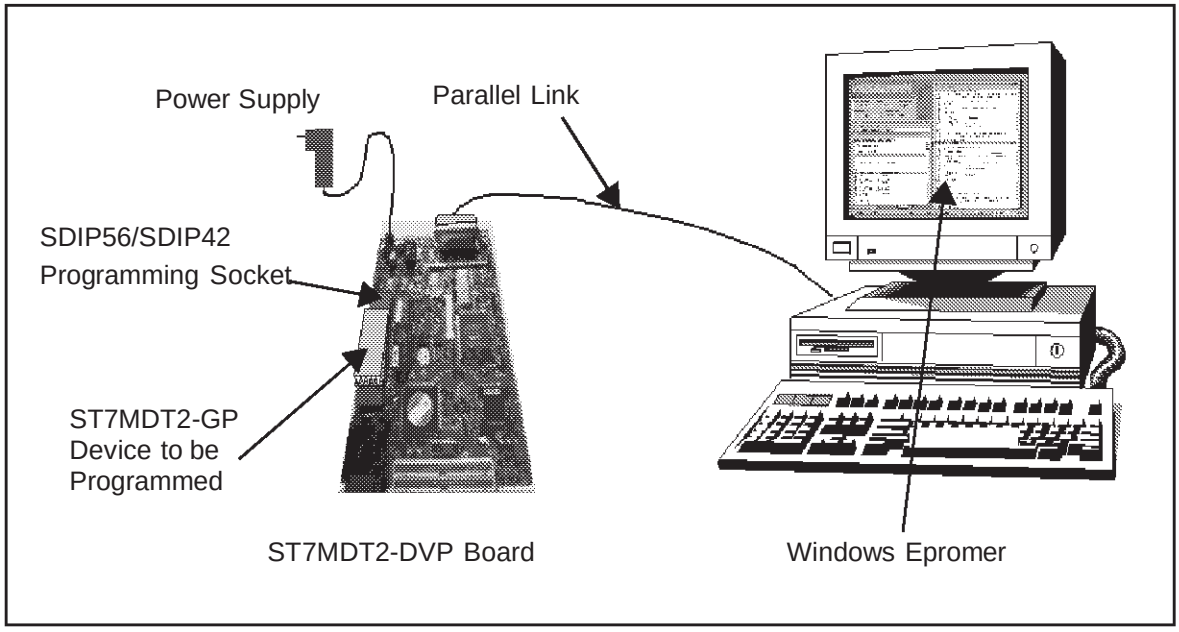
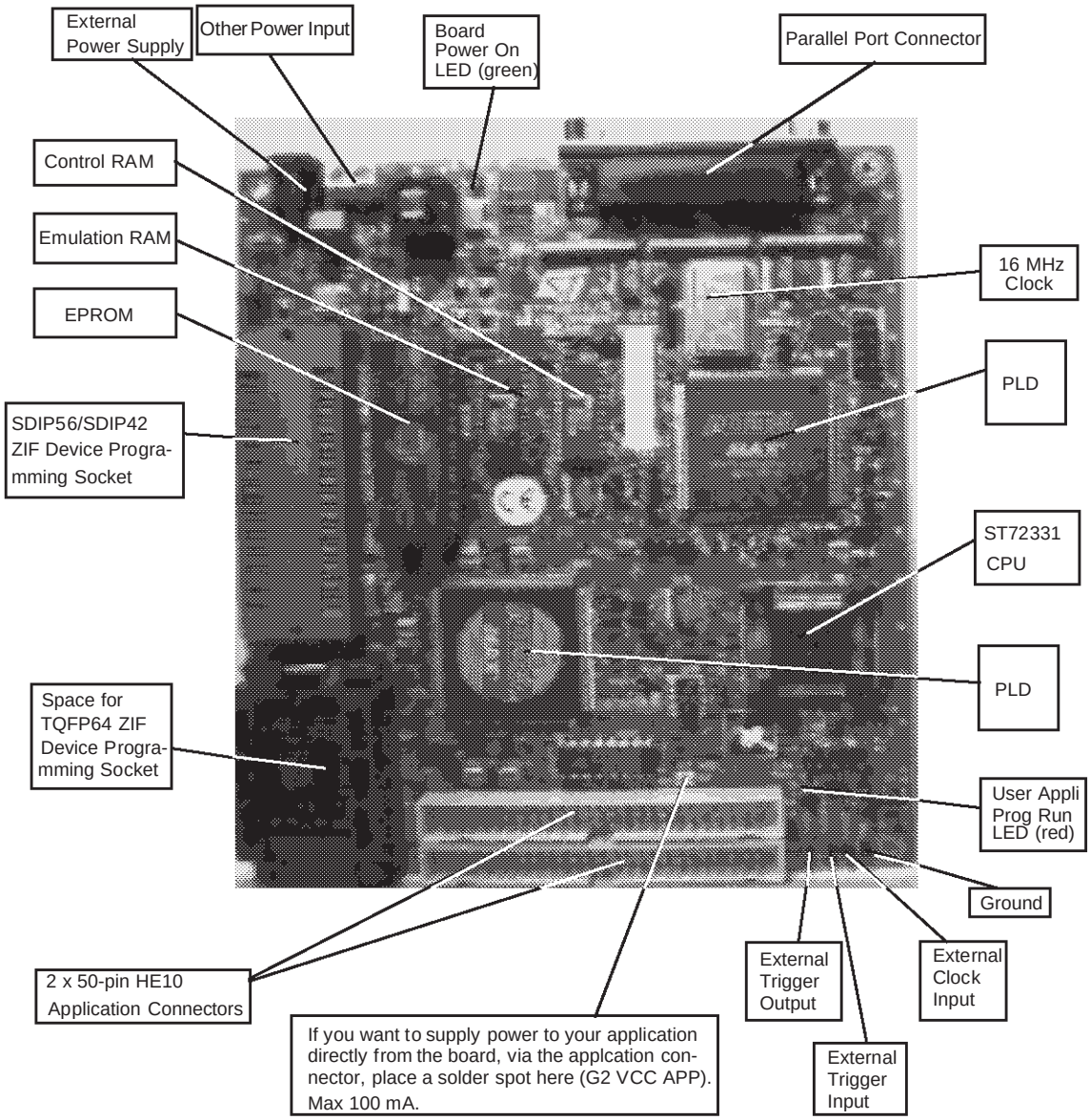


Figure 4. Using the Development Board as an ST7 MCU Programming Board



1.4 Development Board Layout



2 WHAT THE DEVELOPMENT KIT OFFERS YOU

2.1 Overview

Let's suppose that you have just unpacked your ST7MDT2-DVP Development Kit.

Now you are ready to try it.

2.1.1 Connecting and Powering Up the Development Board

1 **Connect the development board (P2 connector) to the parallel port (LPT1 or LPT2) of your PC via the appropriate cable.**

1 **Connect the probe to the board (J1 and J2 connectors) using the two flat cables that have been supplied in the package.**

1 **Power up the board by connecting the power supply that can be found in the package (P1 connector).**

The green POWER LED lights up.

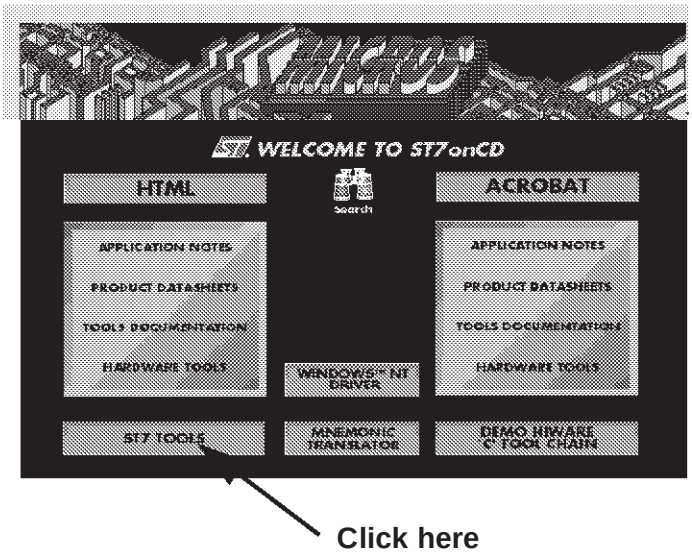
2.1.2 Installing and Setting Up the Software

1 **Insert the delivery CD ROM into your CD ROM drive.**

1 **Using Windows Explorer, open the root directory of your CDROM drive**

1 **Double-click WELCOME.PDF.**

The Welcome Window opens:



1 **Click ST7 TOOLS on the Welcome window.**

The ***ST7 Tool Chain Setup*** introductory window appears on your screen.

Click **Next** to continue.

1 **In the next window, *Choose Destination Location*, Click Next to continue (using the default folder (or directory) for the software to be loaded to.**

1 **In the next window, *Select Components*, click the *Wgdb7 Debugger* and *Development Kit*, *ST Assembler Chain* and *Windows Epromer* check boxes. Leave other check boxes empty.**

Click **Next** to continue.

1 **The next window, *Check Setup Information*, displays the settings you have specified:**

Click **Next** to confirm.

1 **The copying process takes place.**

A progress indicator keeps you informed of the status of the operation. When the copying process terminates, you are directed to the ***Setup Complete*** window.

2.2 Working with the Development Kit

From now on, you can do whatever you want in the scope of your development activities.

You can:

- Code your applications using the ***ST Assembly Chain***,
- Debug your applications using the ***WGDB7 Debugger*** with either the ST7 Simulator (no hardware needed), the Emulator, or the Development Board,
- Program any ST72331N4 series device with the application you just developed, using the ***Windows Epromer*** software.

To start any of these tools, just click the corresponding icon (or name in the cascading menus) in the Windows desktop.

NOTE: Chapter 3, *Getting Started*, will provide you with more detailed information on how to start a session, and how to activate the tools.

3 GETTING STARTED

3.1 Hardware Installation

3.1.1 Antistatic Requirements

3.1.1.1 Testers and Tools

Any tester, equipment, or tool used at any production step or for any manipulation of semiconductor devices must have its shield connected to GROUND.

3.1.1.2 Antistatic Equipment

An antistatic equipment should comprise:

- A conductive table top, made of steel or clean aluminium or covered by an antistatic surface (superficial resistivity equal to or higher than 0.5 Megohm/cm2), grounded through a ground cable (conductive cable from protected equipment to ground isolated through a 1-Megohm resistor placed in series).
- An antistatic floor covering grounded through a conductive ground cable (with serial resistor between 0.9 and 1.5 Megohm).

3.1.1.3 Manipulation of the Development Kit Hardware

Manipulation the development kit hardware must be made at a grounded worktable.

It is mandatory to wear an antistatic wrist or ankle strap, connected to the antistatic floor covering or to the grounded equipment.

It is mandatory to wear antistatic gloves or finger coats.

Nylon clothing is prohibited during manipulation of parts.

The worktable must be free of any non antistatic plastic objects.

The wearing of the antistatic strap must be controlled every day.

3.1.2 Powering Up the Development Board

Proceed as follows:

1 Connect the development board (P2 connector) to the parallel port (LPT1 or LPT2) of your PC via the appropriate cable.

NOTE: The supplied interface cable has been tested in order to operate properly on most PCs. Do not use any other cable, especially if it is longer than the one provided by STMicroelectronics: the board may not operate properly.

The cable should be connected directly to the DB-25 female connector of the PC parallel port. This connector is similar to the one installed on the board. Do not insert any

additional cables or switchboxes between the PC and the board: a malfunctioning of the board may result.

If a dongle is mounted on the PC parallel port, it should not interfere with the programming board. Should you notice a dysfunctioning of the board, remove the dongle and restart the installation procedure.

1 **Connect the probe to the board (J1 and J2 connectors) using the two flat cables that have been supplied in the package.**

1 **Power up the board by connecting the power supply that can be found in the package (P1 connector).**

NOTE: The board can also be fed via the JP1 connector by an external stabilized power supply (5V ± 0.25 V, 1 A) not provided with the Kit.

If the board is fed via the JP1 two-point connector make sure that the right feeders lead to the right polarities.

The green POWER LED lights up.

3.2 Software Installation

To install and setup the ST7MDT2-DVP Development Kit software, follow these steps:

1 **Insert the delivery CD-ROM into your CD-ROM drive.**

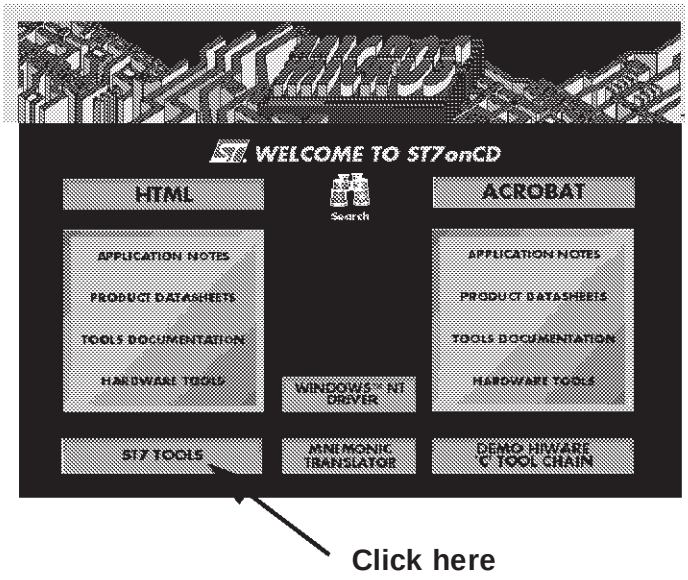
1 **Using Windows Explorer, open the root directory of your CD-ROM drive.**

Table 2. Software Installation Procedure

IF	THEN...
Acrobat Reader is already installed on your system.	Double-Click WELCOME.pdf. When the Welcome screen is displayed, click ST7 TOOLS

Table 2. Software Installation Procedure

IF	THEN...
Acrobat Reader is not yet installed on your system	1. Open the PROGRAM folder/ACROBAT3/ 2. Select and install the appropriate language version of Acrobat (for more details refer to the readme.txt in the CDROM root directory) 3. When Acrobat is installed Double-Click WELCOME.pdf. When the Welcome window is displayed, click ST7 TOOLS

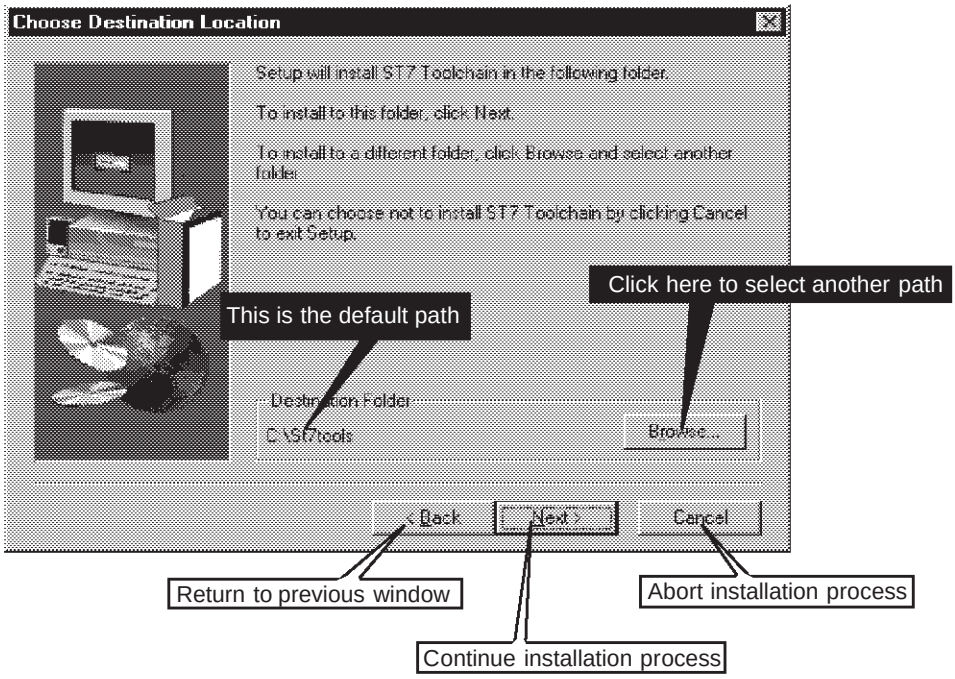


The ***ST7 Tool Chain Setup*** introductory window appears on your screen, referring to the three software components of the ST7MDT2-DVP Development Kit:

- WGDB7 Debugger
- ST Assembly Chain for the ST7 Family
- ST7 Epromer

Click **Next** to continue.

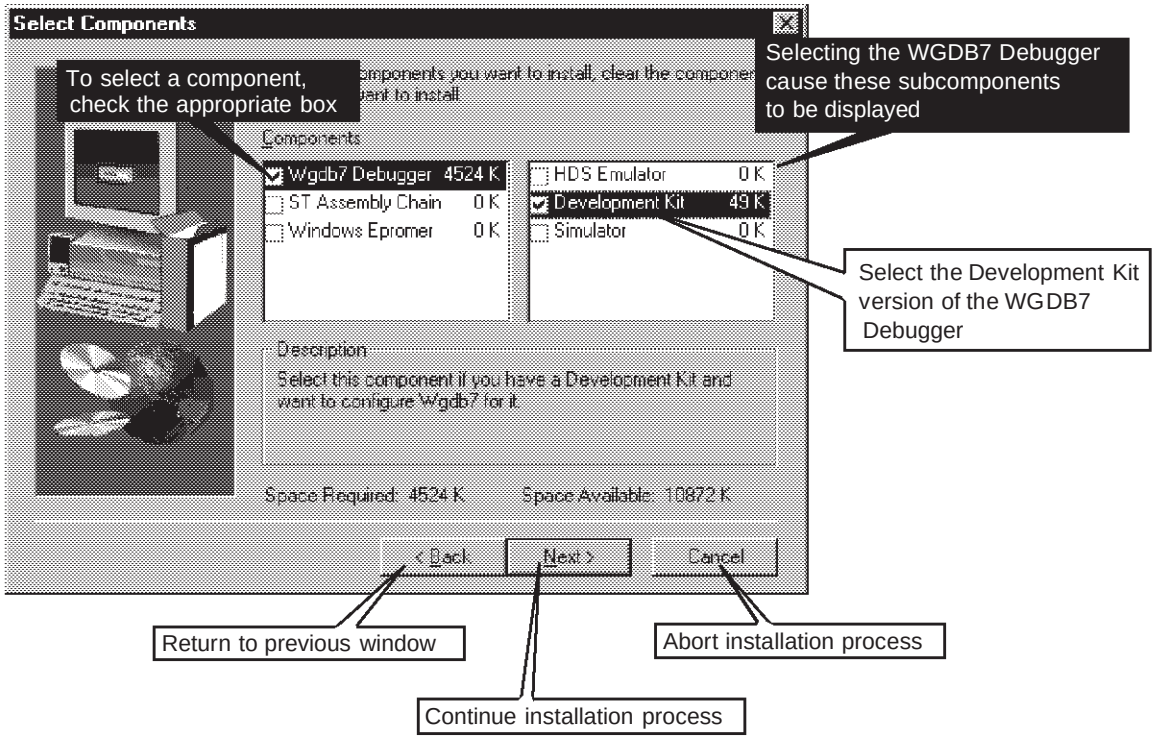
1 **In the next window, *Choose Destination Location*, you will specify the folder (or directory) where to copy the whole ST7MDT2-DVP Development Kit software. Use the default folder (or directory) or choose another folder (or directory):**



Click **Next** to continue.

1 **In the next window, *Select Components*, you will select the software components that are to be copied from the CD-ROM into the folder (directory) you specified before.**

NOTE: If you select the Development Kit, it is not necessary to select the HDS Emulator at the same time (don't check the corresponding box).



Click **Next** to continue.

1 **The next window, *Check Setup Information*, displays the settings you have specified:**

- Destination folder (directory)
- Components to be installed

Click **Next** to confirm. Click **Back** to change any settings.

1 **The copying process takes place. A progress indicator keeps you informed of the status of the operation.**

When the copying process terminates, and if you didn't select the ***ST Assembly Chain*** as a component for the installation, you are directed to the ***Setup Complete*** window (see further on).

If you selected the ***ST Assembly Chain***, you are prompted to modify your AUTOEXEC.BAT file (or your system registry).

These changes affect:

- the **PATH** option, where the path for the components of the Assembly Chain should be added,
- the **METAI** and **DOS4G** environment variables that have to be set to the following val-

ues, respectively:

SET METAI=C:\<install folder>\asm

where **<install folder>** is the installation root folder (directory), St7tools by default.

SET DOS4G=QUIET

You may let the system proceed to the changes or make the changes by yourself. In any case, for the modifications to be effective, you will have to reboot the system. If you make the changes by yourself, the values to be typed can be found in:

C:\<install folder>\asm\St7vars.bat

where **<install folder>** is the installation root folder (directory), **St7tools** by default.

For more information, refer to the *ST7 Software Tools for the ST7 Family* User Manual.

You are then directed to the ***Setup Complete*** window.

By checking the appropriate box, you may display a Release Note for the WGDB7 Debugger, and/or start a debugging session, immediately after the installation is completed.

3.3 Using the ST Assembly Chain

The ***ST Assembly Chain*** components are installed in a subdirectory of the installation root directory, named **asm**.

By default, you will find all the software development tools that constitute the ***ST Assembly Chain*** in:

C:\St7tools\asm

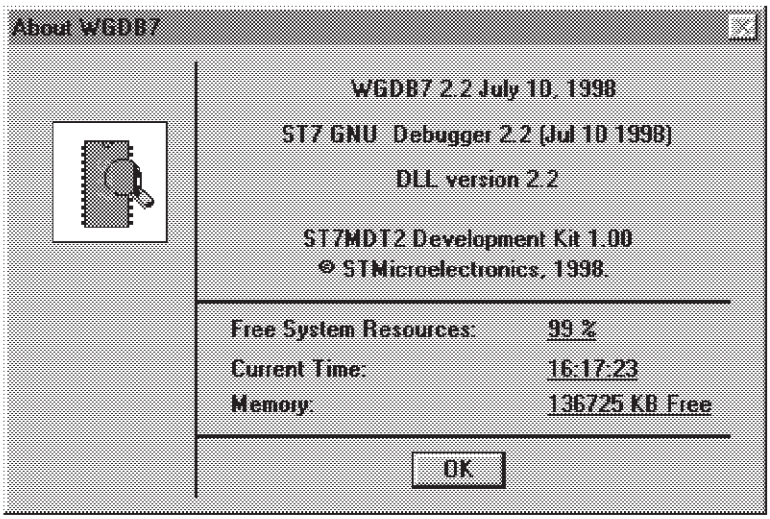
For more information on how to develop applications or programs for the ST7 microcontroller, refer to the *Software Tools for the ST7 Family* User Manual included in the CD-ROM.

3.4 Starting the WGDB7 Debugger

The WGDB7 debugger is installed in the installation root directory. By default, you will find it in:

C:\St7tools

To start WGDB7, just click the WGDB7 Development Kit icon (or name in the cascading menus) in the Windows desktop. The WGDB7 Introductory window appears:



NOTE: To start WGDB7 with the *simulator* you would only click the ***WGDB7 Simulator*** icon or name in the cascading menus in the Windows desktop. Similarly, to start WGDB7 with the *emulator* you would only click ***WGDB7 Emulator*** in the Windows desktop.

The debugging session starts a few seconds later.

To get accustomed to the product, you may start one of the sample programs provided with the package, via the ***File/Open*** debugger menu chain.

The sample programs can be found in:

C:\<install folder>\sample

where <**install folder**> is the installation root folder (directory), **St7tools** by default.

For more information on how to use the WGDB7 Debugger, refer to the *WGDB7 Windows Debugger for the ST7 Family* User Manual included in the CD-ROM.

3.5 Programming ST7 Devices

3.5.1 Target Devices

Once bug-free and ready for operation, the program you just developed needs to be downloaded into an ST7 MCU program space.

With the ST7MDT2-DVP Development Kit, you may program EPROM or OTP versions of these MCUs (*):

ST72121 J2 or J4

ST72311 J2 or J4

ST72311 N2 or N4

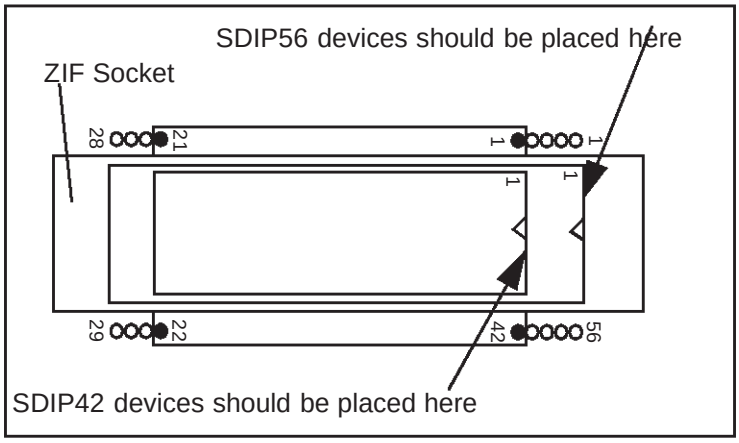
ST72331 J2 or J4

ST72331 N2 or N4

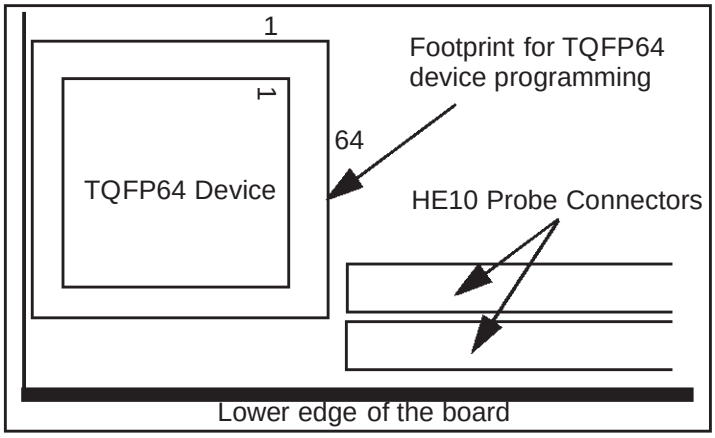
(*) This list is subject to modification

3.6 Device Installation

Place the device into the zero insertion force socket mounted on the board (location U9) for SDIP56 devices, with the erasure window on top and pin 1 matching the uncolored circle No.1 on the board. You may also place SDIP 42 devices on the same socket: in this case the pin 1 of the device should match the solid filled circle No.1, as shown in the diagram opposite.



You may also program TQFP64 devices by adding the appropriate ZIF socket on the footprint provided at the board location U19. Place the device as indicated in the second diagram. The reference number of the socket (not supplied with the Kit) is **ENPLAS OTQ64-08-02**.



CAUTION

Placing the device into a socket without care may damage the device or the board.

Never insert or remove devices when supplied. Devices are supplied only during read or write operations.

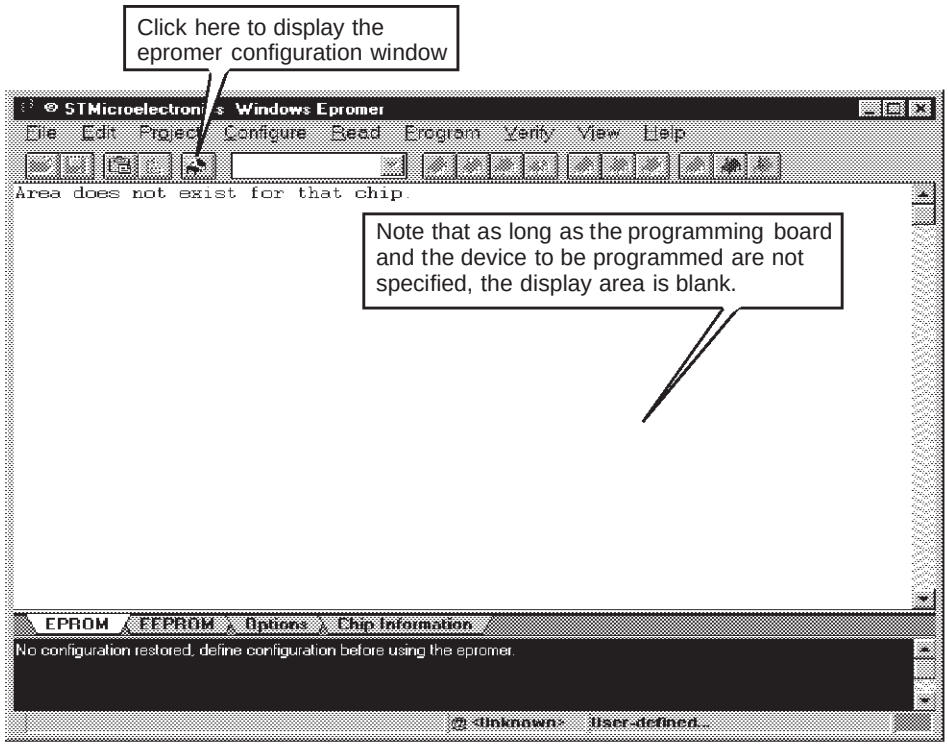
3.6.1 Starting the Windows Epromer

The Windows Epromer (Winee) is installed in the epromer directory. By default, you will find it in:

`C:\St7tools\epromer`

To start the Windows Epromer, just click the corresponding icon (or name in the cascading menus) in the Windows desktop.

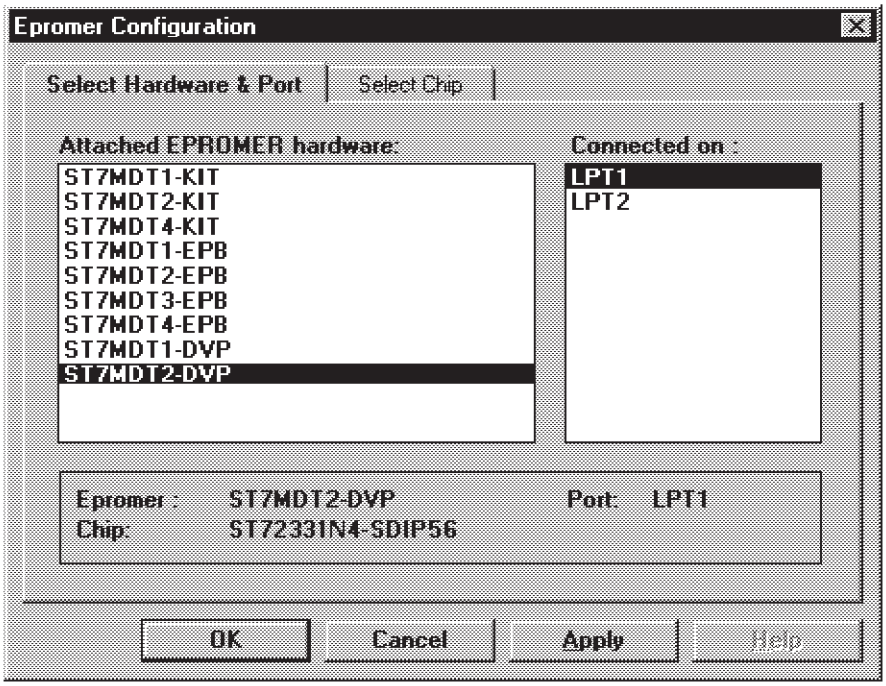
The Epromer main window appears:



3.6.2 Configuring the Epromer

Follow these steps:

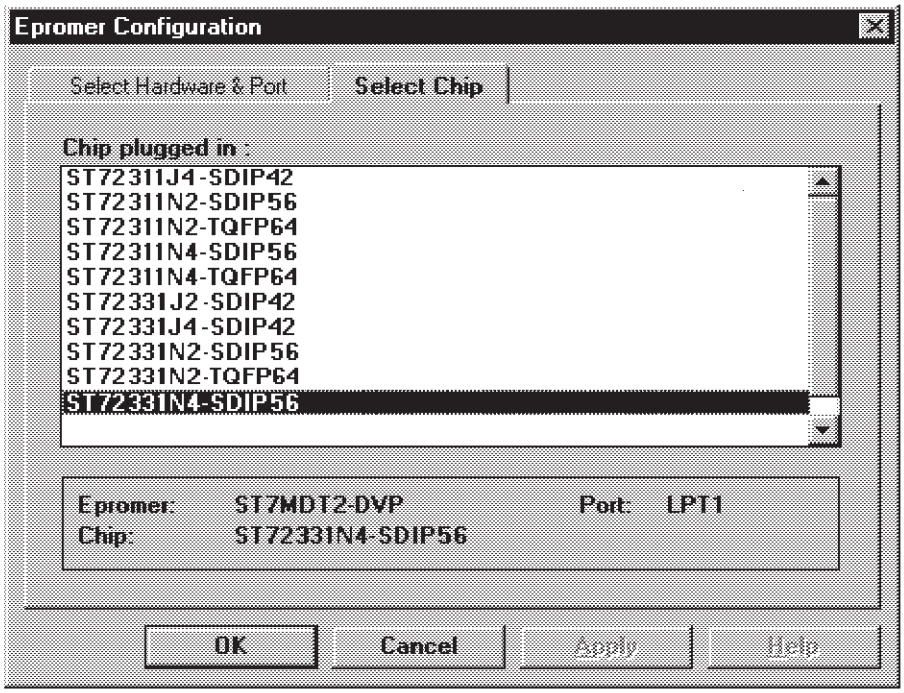
1 In the main window tool bar, click the icon to select the epromer configuration window:



1 **In the list, select the programming board for this ST7MDT2-DVP Development Kit: ST7MDT2-DVP**

1 **Click the *Select Chip* tab to display the list of the devices that can be programmed with this ST7MDT2-DVP Development Kit.**

The list box shown in the ***Select chip window*** appears.



1 In the list, select the device to be programmed:

ST72121 J2 or J4

ST72311 J2 or J4

ST72311 N2 or N4

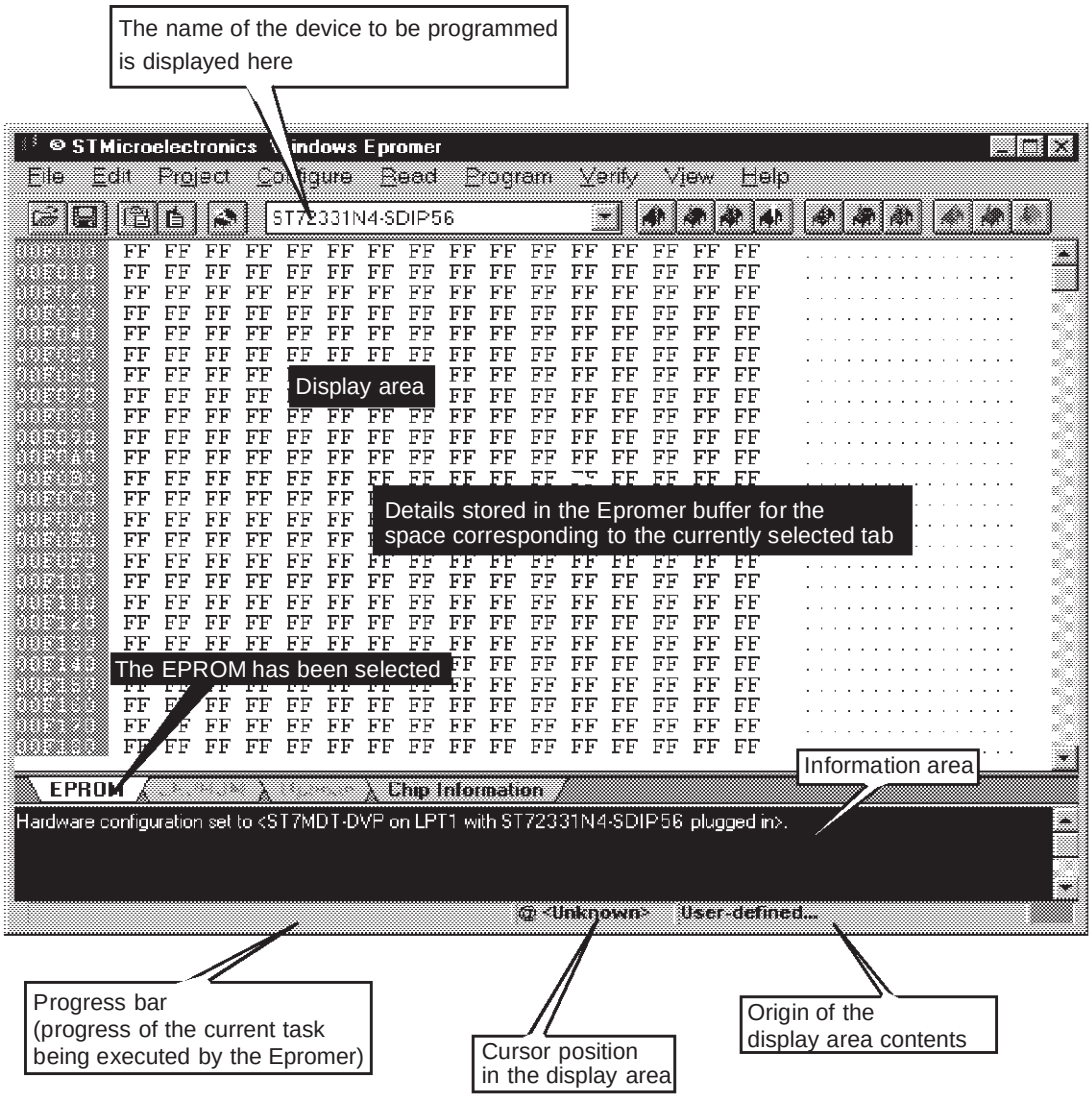
ST72331 J2 or J4

ST72331 N2 or N4

Click **OK** to confirm. The list box closes.

The memory mapping of the specified device now appears in the display area of the main window. It is made up of “FFs”, as one may expect, since programming has not taken place yet.

To view in turn the memory mapping of a selection of devices plugged in, open the configuration window again, then the ***Select Chip*** list box, and click **Apply**. The display area of the main window changes while the list box stays open, for you to choose another chip if necessary.



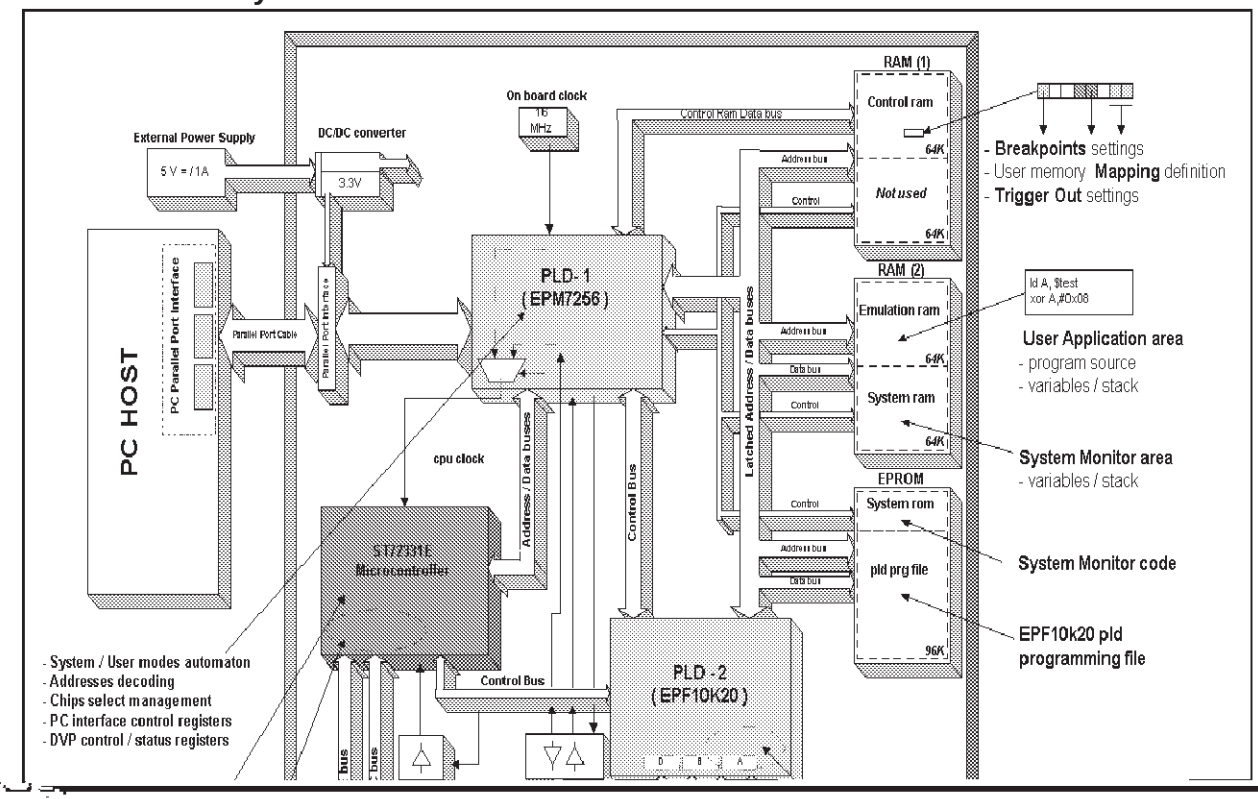
1 Start your programming session.

For more information on how to use the Windows Epromer, click the **Help** command in the main menu bar.

4 HARDWARE FEATURES

4.1 Emulator

4.1.1 General Layout



[redacted]

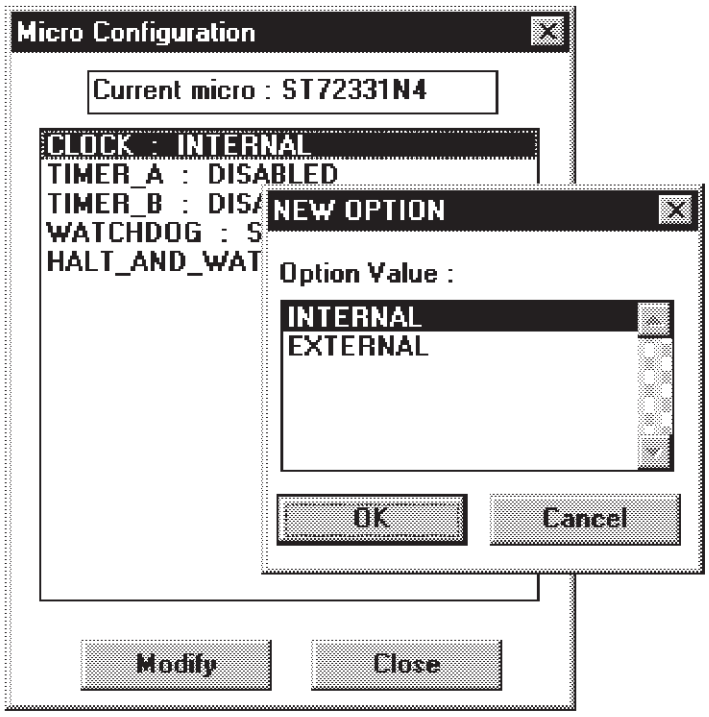
4.1.2 CPU

The board is equipped with an ST72331 CPU that can operate in two different modes: the USER mode and the SYSTEM mode.

4.1.3 Clock

The development board is shipped with a 16-MHz (TTL) internal clock.

You may also use an external clock (TTL-compatible, max 16 MHz) whose signal is supplied via the mini wrapping pin “CLOCKIN located on the board next to the passive probe flat connector (ref.: TP22).



Caution:

In ***normal mode*** (Miscellaneous Register slow mode bit = 0), acceptable CLOCKIN frequencies can take any value between 16 MHz and 250 kHz.

In ***slow mode*** (Miscellaneous Register slow mode bit = 1), the CLOCKIN frequency must take values between 16 Mhz and 8 Mhz.

Note that the board cannot operate with clock signals received from the application board via the OSCIN pin of the probe. You must use the CLOCKIN input instead.

By contrast, the application board can use the development board clock via the OSCOUT pin of the probe. In this case you must place a solder spot on G1 (see Table 5, “Probe Pin Assignment (SDIP56),” on page 35).

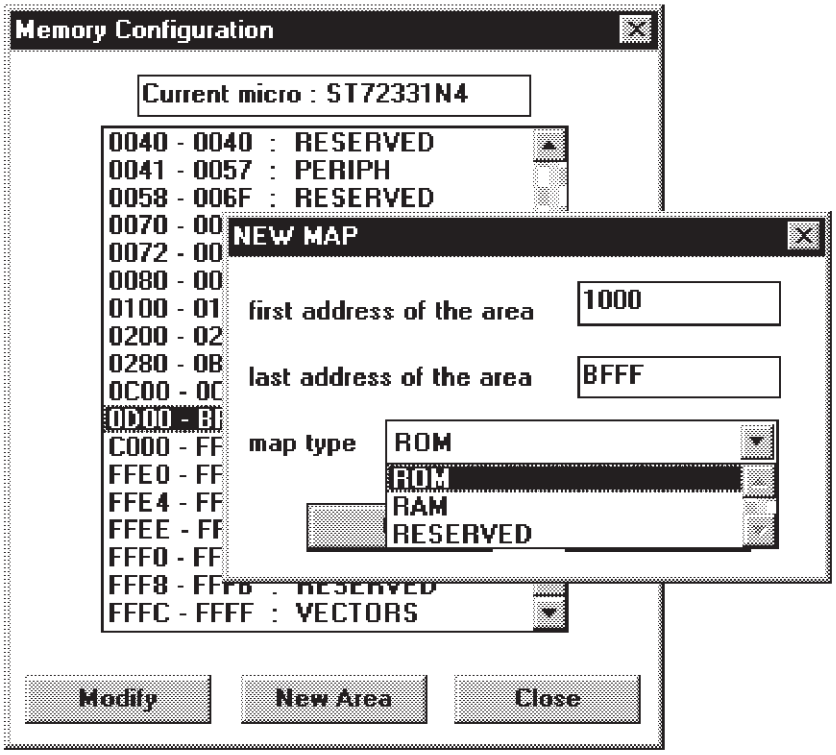
A debugger dialog box lets you choose the clock type (***internal*** or ***external***) as a microcontroller configuration option.

You access these dialog boxes via the following debugger command sequence:

- ***WGDB7 Main Menu***
- ***Command*s** menu
- ***Micro Configuration*** command

(see ***Windows Debugger for the ST7 Family, User Manual***).

4.1.4 Memory



The memory mapping for the emulated device is also configurable. You access this dialog boxes via the following debugger command sequence:

- WGDB7 Main Menu

- Commands menu

- Memory Configuration command

(see ***Windows Debugger for the ST7 Family, User Manual***).

This feature would enable you, for instance, to temporarily increase the ROM size during the development phase of your application.

In the example, a R0M area has been mapped to the 1000h-BFFFh part of a reserved area (0D00h-BFFFh) for the target device (ST72331N4).

4.1.5 On-Chip Peripherals

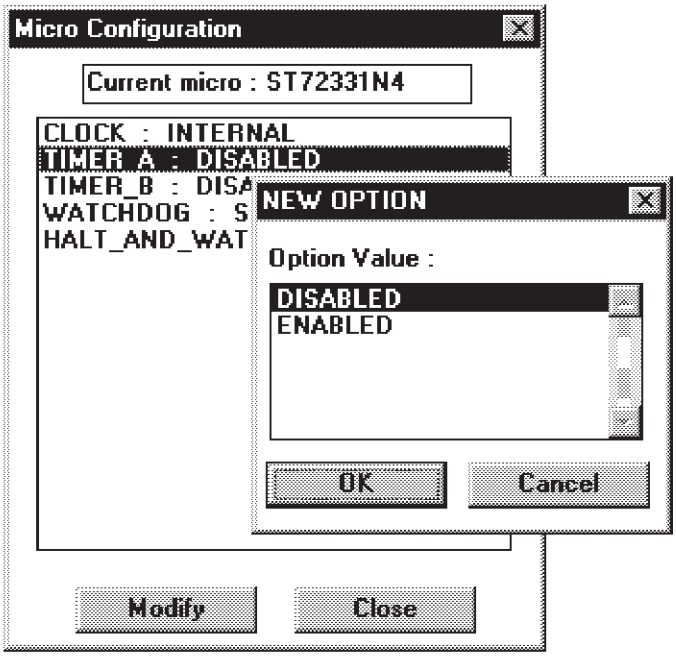
Parallel I/O Ports

32 multifunction bidirectional I/O lines are supported. The I/O lines can be shared between other on-chip peripherals (alternate functions) and any general purpose I/O function defined by the application. Data is input and output via data registers (one for each port). Data Direction and Option registers allow each line to be individually configured to the application's requirements.

16-Bit Timers

Two 16-bit timers, Timer A and Timer B, are available. They consist of a 16-bit free-running counter driven by a programmable prescaler. Both timers feature output compare, pulse width modulation (PWM) and input capture functions with associated registers. This allows applications to measure pulse intervals or generate pulse waveforms. Timer overflow and other events are flagged in a status register with optional interrupt generation.

A debugger dialog box lets you enable/disable the clocks for timer A or timer B as a microcontroller configuration option.



When the DISABLED option is chosen, the timer is frozen as long as the CPU operates in SYSTEM mode (see “CPU” on page 25). For instance, you would use this option to check whether the timer has reached a specified value.

When the ENABLED option is chosen, the timer is continuously operating even in SYSTEM mode. An example of use of this option is for an application in which the PWM (pulse width modulation) output of the timer drives a motor that must keep running.

Analog to Digital Converter

The ADC peripheral multiplexes up to 8 analog input channels. It converts the analog input to 8-bit value using monotonic successive approximation. The analog input voltage must lie within the supply voltage range, which is used as the analog reference.

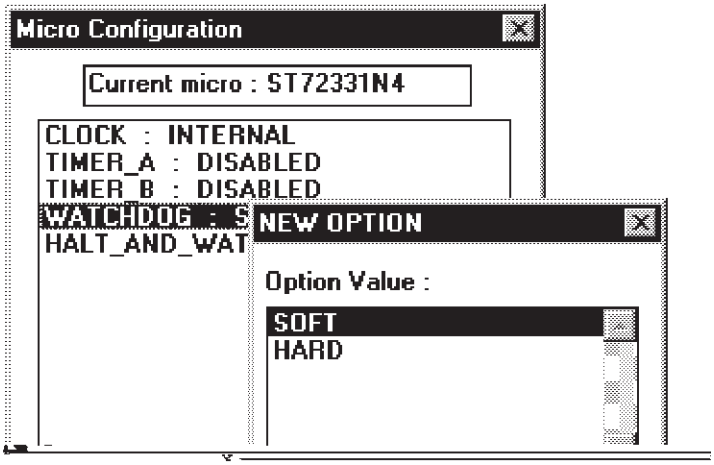
SPI Serial Peripheral Interface

The SPI peripheral is a synchronous serial interface for Master and Slave device communications. Single master and multimaster mode systems are supported for communication with external peripherals or other microprocessors. Dedicated registers and interrupts allow full software control and user defined protocols.

SCI Serial Communications Interface

The Serial Communications Interface (SCI) offers a flexible means of full-duplex data exchange with external equipment requiring an industry standard NRZ asynchronous serial data format. A wide range of baud rates are available using dual baud rate generator systems on both receive and transmit channels. Transmitter and receiver circuits are independent and can operate at different baud rates.

Watchdog Timer



The watchdog timer consists of a 7-bit reloadable downcounter that triggers a device reset when it reaches a predefined value.

During normal operation, the application reloads the counter at regular intervals to prevent a reset occurring. By this means, if the application hangs, the condition is automatically cleared by resetting the MCU.

The watchdog timer can be enabled by software or by hardware. The choice is a microcontroller configuration option.

Device Reset Upon Halt

Normally, after a halt instruction, the watchdog timer, if enabled, causes a device reset to be performed. A dialog box lets you disable this function, by specifying NORESET.

EEPROM

256 bytes of EEPROM data memory are available for non-volatile storage. The EEPROM memory can be reprogrammed many times while retaining data integrity.

4.1.6 Hardware Breakpoint Capabilities

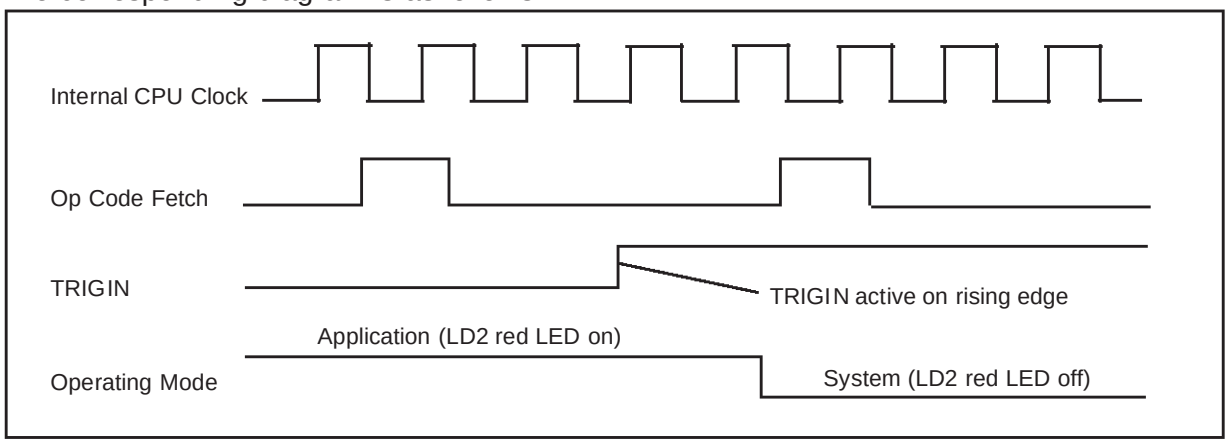
With the ST7MDT2-DVP Development Kit you can define hardware breakpoints that cause your program to stop whenever a defined event occurs. An event can be:

- The occurrence of a memory access via a read operation
- The occurrence of a memory access via a write operation
- The occurrence of an opcode fetch
- The occurrence of a write operation in a write-protected location
- The occurrence of a write operation in a reserved location
- The occurrence of a stack overflow/underflow
- The occurrence of an access to a reserved memory area
- The occurrence of a external input signal (triggered break feature). The signal is conveyed via a mini wrapping pin located on the board next to the passive probe flat connector.

4.1.7 Input Trigger

The development board of the ST7MDT2-DVP Development Kit provides a special input pin (TRIGIN, Ref.:TP21) that can be used to transmit a signal to stop the execution of your application upon the occurrence of an external event. In this case, the program is stopped after the execution of the current instruction.

The corresponding diagram is as follows:



A debugger dialog box lets you choose the waveform mode for the external signal (***Pulse mode*** or ***Windows mode***) as a microcontroller configuration option (see ***Windows Debugger for the ST7 Family, User Manual***).

4.1.8 External Output Trigger

The development board of the ST7MDT-DVP Development Kit features a special output pin through which an external signal can be triggered out. The signal is conveyed via a mini wrapping pin located on the board next to the passive probe flat connector (ref.: TP20).

A debugger dialog box lets you choose the waveform mode for the external signal (***Pulse mode*** or ***Windows mode***) as a microcontroller configuration option (see ***Windows Debugger for the ST7 Family, User Manual***).

4.2 Connection to External User Resources

4.2.1 Pin Description

You may connect an application board to the ST7MDT-DVP Development Kit board for evaluation or debugging in linked emulation mode. The J1 and J2 connectors in the development board provide all the I/O pins needed for the communication. Signals are transmitted via a passive probe to be plugged in the application board at the location of the emulated device.

The following tables show the pin assignment for the J1 and J2 connectors (development board) and the probe (application board).

Table 3. J1 Pin Assignment for Probe Connection (50-pin HE10)

Description	J1 pin No.	J1 pin No.	Description
Ground	1	2	B4 Port
Ground	3	4	B5 Port
Ground	5	6	B5 Port
Ground	7	8	B7 Port
Ground	9	10	D0 Port
Ground	11	12	D1 Port
Ground	13	14	D2 Port
Ground	15	16	D3 Port
Ground	17	18	D4 Port
Ground	19	20	D5 Port
Ground	21	22	D6 Port

Table 3. J1 Pin Assignment for Probe Connection (50-pin HE10)

Description	J1 pin No.	J1 pin No.	Description
Ground	23	24	D7 Port
VDDA	25	26	F0 Port
Ground	27	28	F1 Port
Ground	29	30	F2 Port
Ground	31	32	F3 Port
Ground	33	34	F4 Port
Ground	35	36	F5 Port
Ground	37	38	F6 Port
Ground	39	40	F7 Port
Ground	41	42	C0 Port
Ground	43	44	C1 Port
Ground	45	46	C2 Port
Ground	47	48	C3 Port
Ground	49	50	C4 Port

.

Table 4. J2 Pin Assignment for Probe Connection (50-pin HE10)

Description	J2 pin No.	J2 pin No.	Description
Ground	1	2	B3 Port
Ground	3	4	B2 Port
Ground	5	6	B1 Port
Ground	7	8	B0 Port
Ground	9	10	E7 Port

Table 4. J2 Pin Assignment for Probe Connection (50-pin HE10)

Description	J2 pin No.	J2 pin No.	Description
Ground	11	12	E6 Port
Ground	13	14	E5 Port
Ground	15	16	E4 Port
Ground	17	18	E3 Port
Ground	19	20	E2 Port
Ground	21	22	E1 Port
Ground	23	24	E0 Port
Ground	25	26	OscOut (*)
Ground	27	28	Application Reset
Ground	29	30	A7 Port
Ground	31	32	A6 Port
Ground	33	34	A5 Port
Ground	35	36	A4 Port
Application Vcc	37	38	A3 Port
Ground	39	40	A2 Port
Ground	41	42	A1 Port
Ground	43	44	A0 Port
Ground	45	46	C7 Port
Ground	47	48	C6 Port
Ground	49	50	C5 Port

Table 5. Probe Pin Assignment (SDIP56)

Pin name/Description	Probe pin No.	Probe pin No.	Pin Name/Description
B4 Port	1	56	B3 Port
B5 Port	2	55	B2 Port
B6 Port	3	54	B1 Port
B7 Port	4	53	B0 Port
D0 Port	5	52	E7 Port
D1 Port	6	51	E6 Port
D2 Port	7	50	E5 Port
D3 Port	8	49	E4 Port
D4 Port	9	48	E1 Port
D5 Port	10	47	E0 Port
D6 Port	11	46	Application Vcc (**)
D7 Port	12	45	Not Used
VDDA	13	44	OscOut (*)
Ground	14	43	Ground
F0 Port	15	42	Application Reset
F1 Port	16	41	Not Used
F2 Port	17	40	A7 Port
F4 Port	18	39	A6 Port
F6 Port	19	38	A5 Port
F7 Port	20	37	A4 Port
Application Vcc (**)	21	36	Ground

Table 5. Probe Pin Assignment (SDIP56)

Pin name/Description	Probe pin No.	Probe pin No.	Pin Name/Description
Ground	22	35	Application Vcc (**)
C0 Port	23	34	A3 Port
C1 Port	24	33	A2 Port
C2 Port	25	32	A1 Port
C3 Port	26	31	A0 Port
C4 Port	27	30	C7 Port
C5 Port	28	29	C6 Port

(*) The emulator clock is connected to OSCOUT only when a solder spot is placed in G1 on the development board.

(**) Application voltage: 4.5 to 5.5 V only.

4.2.2 Supplying Power to the Application Board

There are three ways in which you may supply your application board:

1 By using the two test pins located in TP19 (GND) and TP18 (5V) on the development board. Then the current should not exceed 100 mA.

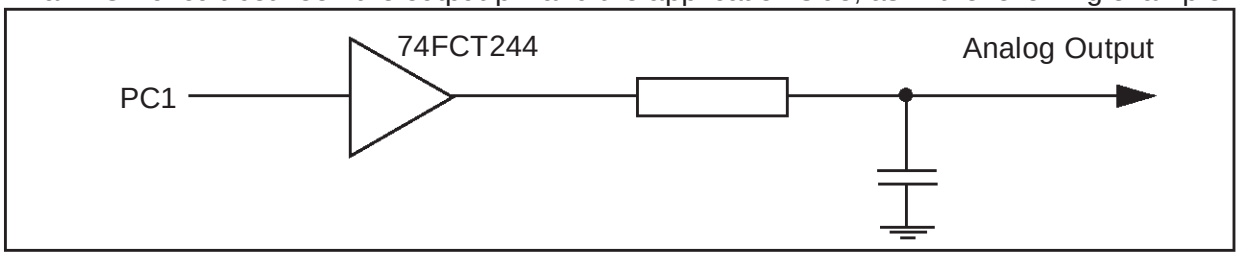
1 Via the VDD pin in the J2 probe connector, after a solder spot has been placed in G2 on the development board. Again, the current should not exceed 100 mA.This method is not recommended.

1 By using your own power supply.

4.2.3 Limitations

- The minimum CPU operating internal frequency of the development board is 250 kHz (for more details, see “Clock” on page 27.
- The application supply voltage should take a value between 4.5 and 5.5 V, different from the 3-6 V range for the devices.
- When an SDIP42 device is used, reset values for complementary SDIP56 pins are impredictable. Also, the value of the bits associated with the unconnected pins can be different from the values of the register bits for the SDIP42 device itself.

- If the probe is unplugged the watchdog flag (WDOGF) cannot be updated unless a solder spot has been placed in G2 (VccApp).
- If any of the PC1 or PF4 ports are to be used for a PWM output it is recommended to insert an FCT circuit between the output pin and the application side, as in the following example:

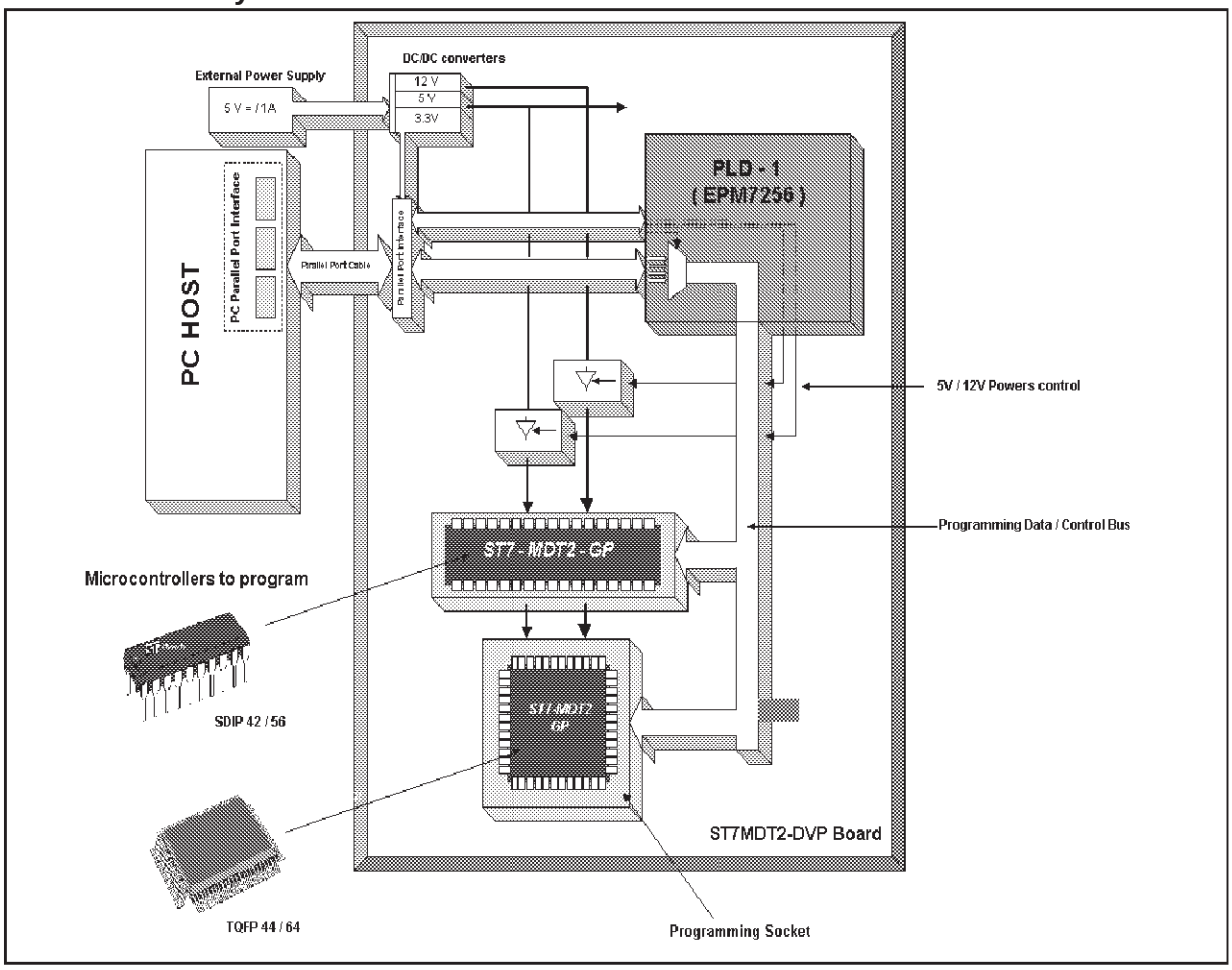


CAUTION

Electrical levels and behaviour on I/O port pins depend on the technology used in the PLD (Programmable Logic Device) referred to as EPF 10K20 on the development board. The technology used is TTL-compatible, different from the ST72331 chip technology (CMOS). Consequently, electrical high state levels on I/O pins are limited to 3.3 V.

4.3 Device Programmer

4.3.1 General Layout



4.3.2 Targets

The development board provides you with the necessary resources to program an ST7 device belonging to the ST72331N4 series: ST72121J2 or J4, ST72311J2 or J4, ST72311N2 or N4, ST72331J2 or J4, or ST72331N2 or N4.

4.4 Link to PC

The ST7MDT2-DVP Development Kit board communicates with your PC via the P2 connector connected to the PC parallel port (LPT1 or LPT2). Centronics, bidirectional, EPP, and EPC configurations are supported.

4.5 Power Supply

A plug-in power supply pack is supplied with the ST7MDT2-DVP Development Kit to be connected to the P1 female jack connector. This power supply must be plugged into the appropri-

ate AC source. Specific sales types indicate the corresponding mains AC voltage supported: 220V, 110V (US), or 240V (UK).

Provided DC power specifications are as follow:

Voltage: 5 V

Current: 1 A

A complementary power supply input (ref. JP1) is provided with the same specifications. When using this power supply, take care to respect the polarities marked next to the two-pole connector.

5 SOFTWARE FEATURES

5.1 Tools

To help you design, code and debug your applications, and program them on chip, the following software has been included in the ST7MDT2-DVP Development Kit:

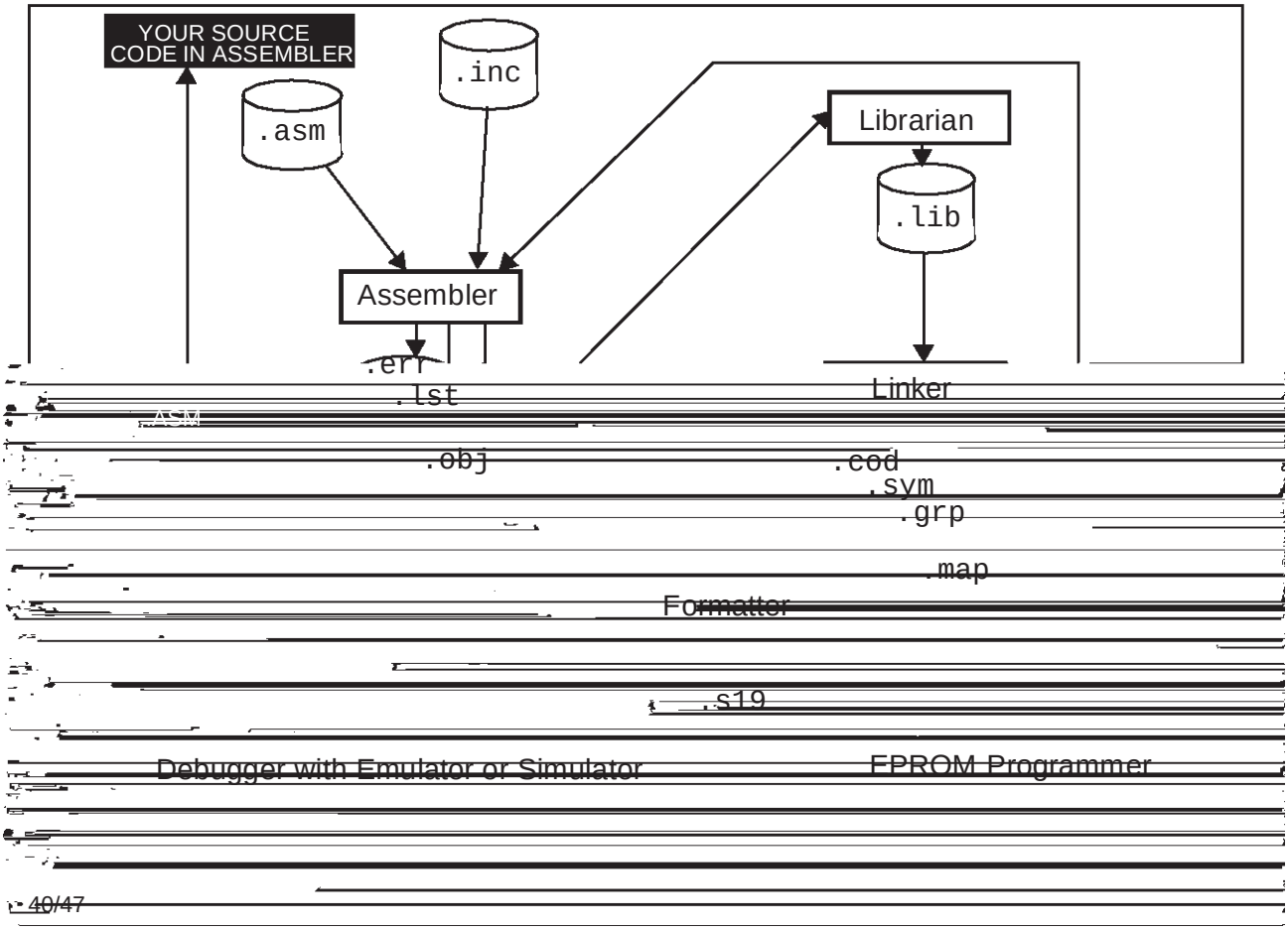
- ST Assembly Chain
- ST7 Simulator
- ST7 Windows Debugger
- Epromer for ST7 MCUs

A stand-alone ST7 instruction help file is also available. In many circumstances, it will help you select the most suitable code for your programs and improve the overall performance of your applications.

5.2 ST Assembly Chain for ST7 Family

The ST Assembly Chain is a cross development system for ST7-driven applications. It includes an assembler, a linker, a formatter and a librarian.

The information flow is summarized in the chart below:



6 TROUBLESHOOTING

6.1 Error Messages

The following messages may be displayed on your screen when starting or operating the MDT2 Development Kit:

Message

```
WGDB7 Communication error.
```

Explanation

The board is not powered or no parallel link has been established between the board and the PC.

Message

```
Cannot find .map symbol file.
```

Explanation

The file you have loaded for the debugging session is not a **.s19** or a **.abs** file.

Message

```
Invalid session. Emulator power off detected.
Please reload your application.
```

Explanation

A temporary power off occurred during a degugging session.

Message

```
Monitor not ready.
```

Explanation

The parallel link between the board and the PC has been disrupted during a debugging session.

Index

Symbols

.asm files 42
.cod files 42
.err files 42
.grp files 42
.inc files 42
.lib files 42
.lst files 42
.obj files 42
.s19 files 42
.sym files 42

A

ADC 31
Analog to Digital Converter 31
Antistatic equipment 15
Application connection 8
AUTOEXEC.BAT file 19

B

Breakpoints (hardware) 33

C

C Compiler Chain (Hiware) 43
Cable for PC Connection 8
Clock 29
Clock type 29
CLOCKIN pin 29
Complementary power supply 41

D

Debugger (main menu) 28
Debugging (simulation-aided) 43
Device Reset Upon Halt 32
Devices in ST72331N4 Series 7
Devices to be programmed 25
DISABLED option (Timers) 31
DOS4G Environment Variable 19

E

EEPROM 32
Emulation-aided debugging 43
ENABLED option (Timers) 31
Environment Variables 19
Epromer 23, 45
Epromer for ST7 MCUs 42
Error Messages 46
Events (breakpoints) 33
External clock 29
External Output Trigger 34

F

FCT circuit 39
Footprint for TQFP64 devices 22

H

Halt and Watchdog 32
Hardware breakpoints 33
Hiware C Compiler Chain 43

I

I/O lines 30
Input Trigger 33
Internal clock 29

L

LD2 LED 28
LEDs (LD2) 28
Link to PC 40

M

Main menu of debugger 28
map files 42
Memory mapping 30
METAI Environment Variable 19
Miscellaneous Register 29
Modes of operation (CPU) 27

Index

N

Normal mode (clock) 29
Nylon clothing 15

O

Operating modes (clock) 29

P

Packages 7
Parallel I/O ports 30
PATH option (AUTOEXEC.BAT) 19
PC connection 8
PC parallel port 40
Pin Assignment for Probe Connection 34, 35
Power supply 40
Power supply (complementary) 41
Programmable devices 25, 40
Pulse mode (external signal) 34
Pulse waveforms 30
Pulse width modulation 30
PWM 30

R

ROM size 30

S

SCI 31
SDIP 42 devices 22
SDIP56 device 22
SDIP56 passive probe 8
SDIP56/42 packages 7
Serial Communicationsl Interface 31
Serial Peripheral Interface 31
Simulation-aided debugging 43
Slow mode (clock) 29
SPI 31
ST Assembly Chain 20, 42
ST7 Simulator 42
ST7 Windows Debugger 42
ST72331N4 Series Summary 7
Structure of the Development Kit 9
Supplying the Application Board 38
SYSTEM mode 27

T

Target devices (to be programmed) 40
Technology in use 39
Test pins 38
Testers 15
Timers 30
TQFP64 devices 22
TQFP64 packages 7
Triggered break feature 33
TRIGIN 33
TTL-compatible technology 39

U

User application connection 8
USER mode 27

W

Watchdog flag 39
Watchdog Timer 32
Waveform mode (external signal) 34
WDOGF 39
WGDB7 debugger 21
WGDB7 Emulator 21
WGDB7 Simulator 21
Windows Epromer 23
Windows mode (external signal) 34
Winee 23

Z

Zero insertion force socket 22
ZIF 22

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